Crosslinguistic influence in second language lexical-grammatical sentence comprehension

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von Ivana Cvekić

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Abstrakt

Die Art des Einflusses der L1 bei der L2-Verarbeitung in Echtzeit wurde bereits mit verschiedenen Methoden und Sprachkombinationen untersucht. Bisher zeigen die Ergebnisse Unterschiede zwischen Lexikon und Syntax. Beispielsweise zeigen aktuelle Forschungen zum lexikalischen Verarbeitung Hinweise auf eine nichtselektive Aktivierung von Sprachen (Dijkstra & Van Heuven, 2002). Es gibt jedoch weniger Hinweise auf einen Einfluss der L1 auf die Morphosyntax, die hauptsächlich für Eigenschaften der Verbunterkategorisierung (Frenck-Mestre & Pynte, 1997), Subjekt-Objekt-Ambiguitäten (Hopp, 2006) und Bindungspräferenzen (Frenck-Mestre, 1997, 2002) gefunden wurde. Die aktuelle Doktorarbeit zielt darauf ab, das Ausmaß der L1 Einflusses auf das L2- Satzverständnis unter hochentwickelten L2-Englischlernenden zu untersuchen, indem die Unterschiede in der Realisierung des grammatikalischen Geschlechts, der Zeitform und des grammatikalischen Aspekts im L1 der Lernenden manipuliert werden.

Daher konzentriert sich die Doktorarbeit auf den Einfluss der L1 auf das L2-Verarbeitung und untersucht, ob lexikalisch-grammatische L1-Informationen im L2-Verständnis aktiviert werden und welche Faktoren sie modulieren. Es gibt drei separate Studien zum Online-Verständnis von Anaphorikpronomen, Verstößen gegen die Koreferenzvereinbarung und vorübergehend mehrdeutigen Sätzen mit verschiedenen L1-Gruppen (d. H. L1-Deutsch, L1-Kroatisch und L1-Spanisch). Die Ergebnisse eine begrenzte Unterstützung für den Einflusses der L1 im Fall des grammatikalischen Geschlechts. Für den Einfluss der L1 auf grammatikalische Aspekt und Zeitform werden keine Beweise gefunden.

Somit zeigen die Ergebnisse, dass es weniger eindeutige Hinweise auf eine L1-Aktivierung während des Lesens des L2-Satzes gibt als auf eine L1-Aktivierung im zweisprachigen Lexikon. Einige der möglichen Faktoren für das Fehlen eines Spracheneinflusses bei der L2-Verarbeitung könnten der Sprachkontext, die Unterschiede zwischen L1 und L2 und die Auswahl der Elemente sein. Außerdem können die Ergebnisse nicht vollständig durch führende L2-Verarbeitungs- und Erwerbstheorien erklärt werden. Die Studie zum grammatikalischen Aspekt unterstützt jedoch die zielgerichtete Verwendung grammatikalischer Informationen beim Verständnis von L2-Sätzen, was den Vorhersagen der Shallow Structure Hypothesis (Clahsen & Felser, 2006) widerspricht.

Abstract

The nature of crosslinguistic influence in real-time L2 processing has been explored with various methods and language combinations and so far, the findings have shown differences between lexicon and syntax. For instance, current research on the mental lexicon shows evidence for nonselective activation of languages (Dijkstra & Van Heuven, 2002),. Yet, there is less evidence for crosslinguistic influence when it comes to morphosyntax, which has been found mostly for verb subcategorization properties (Frenck-Mestre & Pynte, 1997), subject-object ambiguities (Hopp, 2006) and attachment preferences (Frenck-Mestre, 1997, 2002). The current thesis aims at investigating the extent of crosslinguistic influence in L2 sentence comprehension among highly advanced L2 English learners by focusing on the differences in the realization of grammatical gender, tense and grammatical aspect in the learners' L1.

Therefore, the thesis focuses on crosslinguistic influence in L2 processing and it investigates if L1 lexical-grammatical information gets activated in L2 comprehension and which factors modulate it. There are three separate studies on online comprehension of anaphoric pronouns, coreference violations and temporarily ambiguous sentences with different L1 groups (i.e., L1 German, L1 Croatian and L1 Spanish). The results show limited support for crosslinguistic influence in the case of grammatical gender and no support for crosslinguistic evidence in grammatical aspect and tense.

Thus, the results replicate the findings of the studies so far that there is less clear evidence of L1 activation during L2 sentence reading compared to L1 activation in the bilingual lexicon. Some of the possible factors for the lack of crosslinguistic influence in L2 processing might be the language context, L1-L2 differences and the choice of items. Additionally, the results cannot be fully explained by leading L2 processing and acquisition theories. Yet, the study on grammatical aspect does give support for the target-like use of grammatical information in L2 sentence comprehension, which is contrary to the predictions of the Shallow Structure Hypothesis (Clahsen & Felser, 2006).

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List of abbreviations

A	Adjective
AH	Aspect Hypothesis
AJT	Acceptability Judgment Task
BIA	Bilingual Interactive Activation Model
BIA+	Bilingual Interactive Activation Plus
CLI	Crosslinguistic Influence
CRO	Croatian
CFT	Category Fluency Task
D	Determiner
DP	Determiner Phrase
ENG	English
ESL	English as a Second Language
ERP	Event-Related Potential
FEM	Feminine
FRH	Feature Reassembly Hypothesis
FT/FA	Full Transfer/Full Access Hypothesis
FT/FA/FP	Full Transfer/Full Access/Full Parse Hypothesis
GER	German
GJT	Grammaticality Judgement Task
IAM	Interactive Activation Model
IH	Interface Hypothesis
L1	First language
L2	Second Language
LAN	Left-Anterior Negativity
LDT	Lexical Decision Task
M	Mean
MASC	Masculine
N	Noun
NEUT	Neuter
NP	Noun Phrase

NP1	First Noun Phrase
NP2	Second Noun Phrase
PL	Plural
PNT	Picture Naming Task
RHM	Revised Hierarchical Model
RT	Reaction Time
SAGH	Sex and Gender Hypothesis
SD	Standard Deviation
SG	Singular
SPA	Spanish
SPR	Self-Paced Reading
SR Box	Serial Response Box
SSH	Shallow Structure Hypothesis
TOEIC	Test of English for International Communication
TSit	Situation Time
TT	Topic Time
TU	Time of the Utterance
TW1	First Time Window
TW2	Second Time Window

1. Introduction

This dissertation explores crosslinguistic influence in the real-time second language (L2) sentence comprehension among highly advanced adult L2 learners of English, specifically focusing on topics such as grammatical gender, grammatical aspect and tense. The aim of the studies reported in this dissertation is to replicate and expand research on different lexical-grammatical phenomena with different first language (L1) samples in order (i) to test the extent of crosslinguistic influence from the L1 and (ii) to analyze the results in the context of current L2 processing and L2 acquisition models. Therefore, the overall question is if L2 learners of English co-activate L1 lexical-grammatical information during L2 online processing. The general hypothesis that will be put forward is that if there are differences between the L1 and the L2 grammar, L1 crosslinguistic influence will be visible as nontarget-like L2 processing.

Research on L2 processing has mostly focused on the incremental use of L2 information in real-time. Researchers have advocated for either qualitative (Clahsen & Felser, 2006, 2018) or quantitative differences (Hopp, 2010; McDonald, 2006) between native speakers and L2 learners. However, some of the studies on L2 sentence processing have found crosslinguistic influence stemming from the L1 at the lexical and the syntactic level. Research on the bilingual mental lexicon found L1 activation in the production or comprehension of words in isolation (Lemhöfer & Dijkstra, 2004; Van Hell & Dijkstra, 2002), but also in a sentence context (Libben & Titone, 2009; Schwartz & Kroll, 2006). L1 verb subcategorization properties (Frenck-Mestre & Pynte, 1997), L1 attachment preferences (Frenck-Mestre, 2002), case and subject-verb agreement (Hopp, 2010) were also activated during L2 sentence processing, among other types of information.

In the current dissertation, I test for crosslinguistic influences in L2 sentence processing. I systematically manipulate lexical-grammatical differences across three L1s, in order to see if the different encoding of information in the L1 affects possible L1 influence during real-time L2 sentence processing. As for methods, the dissertation at hand uses a lexical decision task, a picture naming task, a self-paced reading task and an eye-tracking study to test for possible L1 crosslinguistic influence. I test the online comprehension of anaphoric pronouns, adverb-tense mismatches and temporarily ambiguous sentences. In particular, the study examines whether L1 lexical-grammatic information gets activated in

L2 processing and whether the (+/-) realization of gender, aspect and tense in an L1 is a factor in the co-activation of the L1in the L2. Building on previous studies with adult L2 learners on grammatical gender (Conklin, Dijkstra, & Van Heuven, 2007), grammatical aspect (Roberts & Liszka, 2019) and tense (Roberts & Liszka, 2013), I discuss the results of the current dissertation in the context of some of current approaches to L2 acquisition and processing, such as the Feature Reassembly Hypothesis (FRH) (Lardiere, 2009), learned attention (Ellis & Sagarra, 2010a, 2010b) and the Shallow Structure Hypothesis (SSH) (Clahsen & Felser, 2006, 2018). The results show that there is (limited) crosslinguistic influence in the case of grammatical gender, but there is no evidence for L1 influence in the case of grammatical aspect and tense. Therefore, the dissertation aims at identifying and defining the extent of crosslinguistic influence in L2 sentence comprehension.

This dissertation is structured as follows. In Chapter 1, I discuss previous research on L2 acquisition and L2 processing. In particular, I focus on L2 parsing models and on L2 models that capitalize on crosslinguistic influence. Furthermore, Chapter 2 presents the study on L1 grammatical gender co-activation in a L2 (English) that lacks grammatical gender. Chapter 3 covers a study on L1 effects on the processing of tense/aspect mismatches between a fronted temporal adverbial and the verb that follows. Chapter 4 focuses on differences in L1s in the encoding of aspect and their effect on the processing of temporary ambiguous sentences. Finally, in Chapter 5, I discuss my findings with regards to previous models of L2 acquisition and processing that focus on L1 effects and/or on reaching a native-like competence.

1.1. Research on L2 Sentence Processing

The real-time sentence comprehension involves the rapid integration of information, including semantic, pragmatic, morphosyntactic and lexical information (Hopp, 2006, 2015, 2016). Processing or *parsing* sentences also includes processes such as building and interpreting hierarchical structures when it comes to syntax, and interpreting words when it comes to lexical items. The assumption in the research on L2 sentence processing is that, in order for a parser to integrate the information rapidly, knowledge of grammatical structure is necessary (for discussion, see Juffs & Rodriguez, 2014). The integration of information also includes establishing cohesion between elements in a sentence, such as gender agreement between a noun and a pronoun, or number agreement between a noun and a verb.

Sentence processing comprises both the integration of information and the active prediction (anticipation) of information. Anticipation has also been identified as an integral part during sentence comprehension (and production), which entails active anticipation based on the input that the reader/listener receives (Altmann & Mirković, 2009; Kaan, 2014). However, the current dissertation will look at the results from the perspective of information integration. The rest of Chapter 1 is structured as follows: Section 1.1.1. will cover L1 processing in more detail and some of the dominant L1 models, Section 1.1.2. will report some studies of L2 sentence comprehension and will be followed by Section 1.1.3. that will introduce different approaches to L2 processing.

1.1.1. L1 processing.

Research on L1 and L2 sentence comprehension has used various phenomena (e.g., garden-path sentences) to test how readers parse sentences, i.e. how syntactic structures are constructed in L1 and L2 processing. Temporarily ambiguous sentences or so-called garden-path sentences, have mostly been used in L1 sentence research in order to test the incremental use of grammatical information. Locally ambiguous sentences are designed to lead the reader down a garden-path, or, in other words, to an incorrect analysis, which should later be reanalyzed. For example, the sentence *While the band played the song pleased everyone* leads the readers to use an incorrect analysis which would be apparent only when the reader encounters the verb *pleased*. The reader initially interprets the noun phrase (NP) *the song* as an object of the verb *played*. However, when the verb (*pleased*) is encountered, the reader realizes that the NP that was previously interpreted as the object was actually a subject of the following clause. This particular instance of garden-path sentences is called object-subject ambiguities, however, there are other ways to achieve ambiguity, for example through embedded relative clauses.

Garden-path sentences have been used first with monolingual speakers (Frazier, 1979). *Principle-based* models argue that parsing principles in the first stage are exclusively syntactic and are used for initial structure building. That means that the syntactic information is privileged compared to other types of information, such as discourse or semantic information. The explanation for the initial erroneous analysis were illustrated by the principles of *Minimal attachment* and *Late* c*losure*. Minimal attachment stands for the preference for attaching the upcoming material as long as the sentence has the fewest nodes possible (Frazier, 1979; Juffs & Rodriguez, 2014). The end construction should still follow the grammaticality of the target language. Late closure stands for the integration of the upcoming material into the clause that is processed at that moment (i.e. the currently open phrase). In the case of our example sentence, minimal attachment would integrate *the song* as an object rather than a subject of a main clause, because the latter option would include more nodes. As for late closure, the parser should continue working on the same sentence and should, therefore, interpret *the song* as the complement to the verb *played.* Later in research, garden-path sentences have also been used for L2 processing to investigate if L2 learners also integrate information incrementally (Juffs & Harrington, 1996).

Other models of L1 processing, such as *constraint-based* models, argue for parallel competition of information, meaning that several types of information are activated at the same time and that the information does interact. This means that all types of information are activated in parallel, i.e. semantic, syntactic, plausibility and frequency, and they act as cues that compete with each other (MacDonald, Pearlmutter, & Seidenberg, 1994; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995). Yet, other models, such as exposure-based models (e.g., the *Tuning hypothesis*) state that learners record frequencies of all syntactic ambiguities and overall syntactic information in the past which in turn helps them resolve ambiguities in the present (Brysbaert et al., 2011; Cuetos, Mitchell, & Corley, 1996; Mitchell, Cuetos, Corley, & Brysbaert, 1995). Therefore, their L1 experience can potentially resolve ambiguities.

An expectation-based model of sentence processing is the *Surprisal model* (Hale, 2001; Levy, 2008), which states that every step of the way during sentence processing the parses analyzes the probability of how the sentence should continue based on the context. This means that all types of information are used in the process. Hybrid models such as the *Unrestricted race model* (Gompel, Pickering, & Traxler, 2000; van Gompel, Pickering, Pearson, & Liversedge, 2005) are a combination of several stages. For instance, in the first stage there is a constraint-based competition between different information types, then the parser commits to the 'best' analysis which is later reanalyzed in the second stage. This means that the parser initially builds multiple syntactic structures in parallel.

To sum up, research on L1 sentence processing has mostly focused on how the information is processed in real-time and if there is any preference to a certain type of information more than others. It seems that native speakers can readily integrate lexical, semantic, discourse and syntactic information in real-time. Now the question is if the same type of information is integrated with L2 learners or if there is a fundamental difference between the two language groups. The following section will cover data obtained from L2 learners.

1.1.2. L2 processing.

While in L1 research, sentence comprehension is described as an easy and rapid process, L2 research found that learners had difficulty in integrating L2 information (Roberts, 2013). Some studies on sentence processing have shown differences between L1 and L2 parsing of hierarchical structures and filler-gap dependencies (Felser, Roberts, Marinis, & Gross, 2003; Marinis, Roberts, Felser, & Clahsen, 2005; Papadopoulou & Clahsen, 2003), as seen in failure by L2 learners to build hierarchical structures in real-time. L2 learners were also less successful at anticipating upcoming information compared to native speakers (Grüter, Lew-Williams, & Fernald, 2012; Hopp, 2013; Lew-Williams & Fernald, 2010). Therefore, L2 research has found mixed evidence for learners' use of syntactic information in real-time sentence processing. Overall, what could be noticed is that there is much more variability in L2 processing compared to L1 processing. The question is: what guides those differences? The following section will cover influential models of L2 parsing, mostly focusing on the Shallow Structure Hypothesis (SSH) (Clahsen & Felser, 2006) which will be used as the backdrop against which I discuss the results of my study.

1.1.3. Models of L2 processing.

Various models of L2 sentence processing tried to answer the nature of the differences encountered in L2 research. Some studies argue for qualitative differences between L1 and L2 processing, while others assume that there only quantitative differences, i.e. that L2 processing can be explained by other factors (e.g., capacity limitations or insufficient L2 proficiency). When zooming in on difficulties in L2 incremental use of morphosyntax, Clahsen and Felser (2006) put forward the *Shallow Structure Hypothesis* (SSH) which argues that L2 learners underuse structural syntactic information i.e. they mostly use 'shallow' processing. This means that L2 learners mostly rely on lexical, semantic and pragmatic information (i.e., world knowledge, among others), and focus on the surface word order, rather than building hierarchical structures during parsing. Research has mostly been done on ambiguous sentences, showing that late L2 learners rely more on lexical-semantic cues (Felser et al., 2003; Papadopoulou & Clahsen, 2003). However, Clahsen and Felser (2006) also point out that there might be other factors that affect the underuse of syntactic information in L2 processing, such as general cognitive limitations (e.g., working memory capacity), a lack of automaticity (Segalowitz, 2003) or L1 processing strategies (Frenck-Mestre & Pynte, 1997). The studies that led to the SSH looked at NP attachment preferences (Dussias, 2003; Felser et al., 2003; Papadopoulou & Clahsen, 2003), the plausibility of subject-object ambiguities (Felser & Roberts, 2004) and *filler-gap-dependencies* (Juffs & Harrington, 1995; Marinis et al., 2005), to name a few.

In a more recent paper (Clahsen & Felser, 2018), the authors argue that there might be L1 effects, however, the SSH does not aim at testing them. Other factors that might influence L2 processing, according to Clahsen and Felser (2018), are L2 exposure, L2 proficiency and the age of onset. This means that both syntactic and semantic information is activated in parallel, although the learner is shown to rely more on nongrammatical information, but that other factors (i.e., L2 proficiency, L2 exposure and the age of acquisition) can affect the underuse of structural information.

In neuropsychological studies, Ullman (2001) addresses differences between L1 and L2 processing by using the distinction between declarative and procedural memory. The Declarative/Procedural model (Ullman, 2001) states that L1 processing relies on both declarative and procedural memory, and L2 processing on declarative memory. The declarative memory system is in charge of storing ‘arbitrary related information’, such as vocabulary, and procedural memory system is in charge of computing grammatical rules (Ullman, 2001, pp. 37, 45). Because L1 and L2 speakers learn the language at different points in time, a critical period (i.e., decline of brain capacity) conditions the success of L2 acquisition. Native speakers are predicted to use both types of memories (i.e., declarative and procedural), while L2 learners are predicted to rely mostly on declarative memory due to maturational constraints (Morgan-Short & Ullman, 2011).

A specific type of capacity models that looked into differences between L1 and L2 parsing is the *Interface Hypothesis* (IH) (Sorace, 2011), which was originally based on offline L2 production and comprehension studies (Belletti, Bennati, & Sorace, 2007; Sorace & Filiaci, 2006). The IH differs from the SSH in that it states that those features that are at the interface between syntactic and cognitive domains will cause difficulties for learners (e.g., syntax-discourse interface). A study by Sorace and Filiaci (2011) found that even though the use of null and overt pronouns is dependent on discourse in L1 Italian acquisition, L2 speakers tended to interpret overt pronouns as still refering to the same topic and not as a topic shift. The reason why learners show differences in L2 parsing of syntax-discourse interfaces is because they have to monitor grammar and discourse at the same time, which makes the process more costly.

Capacity-based models claim that differences between L1 and L2 processing due to capacity limitations (e.g., in working memory) (e.g. McDonald, 2006; Hopp, 2010). In other words, the lack of L2 incremental integration of hierarchical information is argued to be caused by the 'shortage of computational resources that affect online L2 processing' (Hopp, 2009, p. 464). For example, Dussias and Piñar (2010) found that only the highly proficient L2 learners used the plausibility information in a native-like manner, which indicates that the higher proficiency increases cognitive resources of L2 learners.

Cunnings (2017) introduced a cue-based model of L2 processing that could potentially explain structurally less detailed parsing of L2 learners. The model claims that L1 and L2 differences are due to memory encoding, storage and retrieval operations that underlie successful language comprehension (Cunnings, 2017). The model argued that native speakers and bilingual speakers assign different weights to syntactic and discourse-level cues when retrieving information from memory, and also that L2 learners witness similarity-based interference during L2 processing. Retrieval cues are compared between items, then the 'best fit' is selected by activating retrieval cues even more, and ultimately, they get retrieved. Cunnings (2017) conducted studies on filler-gap dependencies, agreement and anaphora resolution.

Opposed to the SSH, capacity-based models and cue-based models, another type of general cognitive models used experience to explain L1 and L2 processing differences, such as the model by Mitchell et al. (1995). The model argues that the cumulative experience (i.e., frequency information) affects parsing, which would in the case of L2 learners be both L1 and L2 experience. This information is later adjusted based on the further exposure to the L2. The more experience readers have with L2 ambiguities, the higher the possibility the reader will resolve them more quickly based on the previous resolution (Mitchell et al., 1995).

Moreover, the Competition Model (MacWhinney & Bates, 1989) takes a functionalist approach, which looks at general cognitive mechanisms guiding L2 processing, and it argues that learners use different cues (e.g., case, gender agreement and word order) in understanding the meaning of a sentence. The strength of these cues is tied to their reliability and is language-specific, which means that in order to parse similarly to native speakers, language learners have to adjust the cues when using the L2. If the cues are not adapted to the target language, then the L1 will interfere with the L2 sentence interpretation. The adaptation of the cues mostly depends on L2 cue availability (i.e., frequency) and reliability (i.e., frequency of correct use in a certain context). Because the learners have been exposed to their L1 for longer, the L1 is more entrenched in the mind than the L2. If L1 and L2 are similar, there will be no competition, which ultimately leads to positive transfer. Negative transfer will occur when L1 and L2 cues are different, which leads to their competition. The use of L1 cues happens mostly in the beginning, later learners slowly transition to L2 cues by adding more strength to them.

The debate on qualitative vs. quantitative differences is still ongoing and research showed support for both approaches from various studies. Thus, it is still not clear if the mechanisms between L1 and L2 processing fundamentally differ. On the one hand, the SSH (Clahsen & Felser, 2006) argues for age-related qualitative differences, while other capacity-based, experience-based and cue-based models argue for quantitative differences influenced by factors such as memory capacity, cumulative experience and cue strength. Even though some models acknowledge crosslinguistic influence, most of them do not focus on the nature or mechanisms underlying crosslinguistic influence.

1.2. Crosslinguistic Influence in L2 Acquisition and Processing

Crosslinguistic influence has been studies in L2 acquisition and has usually been referred to as *transfer* (Schwartz & Kroll, 2006) and it mostly included L1 transfer in the L2, whether it is facilitative (positive) or not (negative). Yet, when we talk about online processing, *co-activation* is the term that is mostly used to talk about the nonselective activation of languages at all times. This thesis acknowledges the difference between the terms *transfer*, *crosslinguistic influence* and *L1 co-activation*, but will use crosslinguistic influence as a synonym for L1 co-activation, even though crosslinguistic influence can encompass effects in both L1 and L2.

In L2 processing, studies have recorded L1 influence on both the morphosyntactic level (Hopp, 2006, 2010; Jackson, 2008), and on the lexical level (Lemhöfer, Dijkstra, & Michel, 2004). Some studies have found target-like parsing in the L2 for number marking (Lew-Williams & Fernald, 2010) and grammatical gender marking (Dussias, Valdés Kroff, Guzzardo Tamargo, & Gerfen, 2013), provided that the learners' L1s instantiate grammatical gender. There were also studies that have shown that L2 sentence comprehension does not differ from L1 sentence processing as long as L2 learners have a high, near native-like proficiency (e.g. Hopp, 2006; Rossi, Gugler, Friederici, & Hahne, 2006) or are exposed to a naturalistic input (Plitsiakis & Marinis, 2013). Yet, there seems to be less clear evidence of L1 activation during sentence reading compared to crosslinguistic activation in the bilingual lexicon. In this section, crosslinguistic influence at the word and sentence level will be reported. Moreover, approaches to L2 acquisition which advocated for crosslinguistic influence will also be discussed, as they will be used as a background for discussing the results of my studies.

1.2.1. Word level.

Research on bilingual word recognition has witnessed an increase in studies that give evidence for crosslinguistic influence (Dijkstra & Van Heuven, 2002; Dijkstra, Van Heuven, & Grainger, 1998; Lemhöfer & Dijkstra, 2004). One of the main questions regarding the bilingual mental lexicon is if it is shared between languages, or if there are two separate lexicons. Some studies on word recognition and production tried to address this question by using words that are similar in form and meaning between languages (i.e., cognates) and with words that have the same form but differ in meaning (i.e., interlingual homographs). For example, the word *album* in English is the same in form and meaning as the German word *Album*, thus, the word is a cognate. However, words like *handy* in English and *Handy* ('cell phone') in German are interlingual homographs because the words have the same form but they do not refer to the same concept. The studies on the bilingual mental lexicon tested the assumption that lexical access is non-selective, i.e. words are activated across languages. What they have found is that words that match in length, frequency and neighborhood size, but that only differ in lexical overlap (cognates vs. word translations) were processed at different speeds. The quicker recognition and production of cognates was taken as evidence that both languages are activated even when one language is in use (Dijkstra, 2005). In sentence comprehension, interlingual homographs (words with the same form but different in meaning) had the effect of slowdowns on bilingual readers (Libben & Titone, 2009), which again argued for the non-selectivity in the bilingual mental lexicon. Since those words have a different meaning in different languages, the retrieval of the appropriate meaning can affect the speed of L2 processing.

Currently, one of the most influential models of the bilingual mental lexicon is the *Bilingual Interactive Activation Plus Model* (BIA+) by Dijkstra and Van Heuven (2002), which advocates the integrated nature of the lexicon and the non-selectivity of lexical access (i.e., activation of words in both languages regardless of the language in use). What is more, the BIA+ model was supported by studies on cognates in isolation (Duyck, Van Assche, Drieghe, & Hartsuiker, 2007; Lemhöfer & Dijkstra, 2004; Schwartz & Kroll, 2006; Van Assche, Drieghe, Duyck, Welvaert, & Hartsuiker, 2010; Van Hell & Dijkstra, 2002). Moreover, research on the bilingual lexicon found support for crosslinguistic influence that persists even in a sentence context (Libben & Titone, 2009; Schwartz & Kroll, 2006; Titone, Libben, Mercier, Whitford, & Pivneva, 2011; Van Assche, Duyck, Hartsuiker, & Diependaele, 2009). More details about the research on the bilingual mental lexicon will be discussed in Chapter 2.

While research on the bilingual lexicon has mostly focused on cognates, interlingual homographs and pure L1-L2 translations (Lemhöfer & Dijkstra, 2004; Schwartz & Kroll, 2006), models such as the *Revised Hierarchical Model* (RHM) (Kroll & Stewart, 1994) looked at word production and translation in L2 acquisition. The model claims that the meaning of a word can be directly accessed through the lemmas of L1 equivalents. However, L2 words have to be translated first in order to access the meaning, which means that the link between L1 and L2 words has to be established in order for L2 meaning to be accessed. The RHM advocates for separate lexicons which are connected to one conceptual system that stores the meanings of words. This means that the L1 is mediating the use of the L2 at lower proficiency levels, but as the proficiency gets higher, the L2 can directly access the conceptual system.

As a conclusion, at the word level there is ample evidence supporting crosslinguistic influence even when a task is in a monolingual mode (Dijkstra & Van Heuven, 2002; Lemhöfer & Dijkstra, 2004; Van Heuven et al., 1998). The facilitation effect of cognates and the inhibition effect of interlingual homographs is visible in sentence comprehension (Libben & Titone, 2009; Schwartz & Kroll, 2006; Titone et al., 2011; Van Assche et al., 2009), while the effect of L1 is also visible during translation (Kroll & Stewart, 1994). Therefore, research on the bilingual mental lexicon mostly supports the non-selective activation of languages, i.e. crosslinguistic effects in L2 acquisition and processing.

1.2.2. Sentence level.

Crosslinguistic influence was also present in L2 sentences processing. Studies so far have found that L2 learners activate L1 lexical-thematic information, i.e. verb subcategorization in terms of transitivity (Frenck-Mestre & Pynte, 1997). However, there were other studies which looked at reduced relative clauses (Jacob, 2009), attachment preferences (Frenck-Mestre, 2002) and subject-object ambiguities (Hopp, 2006). One means of testing if there is L1 co-activation is by using crosslinguistic garden-path sentences (Jacob, 2009). Crosslinguistic garden paths are sentences that follow one structure in L1 and another structure in L2 'when translated word-by-word' (Kaan, 2015, p. 801). Thus, L1 co-activation can be tracked based on where the L1 and L2 differ. For instance, Jacob (2009, p. 94) analyzed L1 influence in the interpretation of full and reduced relative clauses when placed in a subordinate clause (1) or in a main clause (2) in a self-paced reading task.

(1) When the barmaid (who) Damian deceived and betrayed attempted to steal the spoons nobody paid attention.

(2) The barmaid (who) Damian deceived and betrayed attempted to steal the spoons when nobody paid attention.

In English, both (1) and (2) are SVO sentences. Yet, in German, (1) follows a SOV structure (*Als die Bardame Damian hinterging und betrog…*) and (2) follows a SVO structure. This means that the two languages differ in word order only in reduced relative clauses that are located in a subordinate clause. The study found that L1 German learners of English displayed longer reading times for (1) after the reduced relative clause. L1 English native speakers and L1 French learners of English did not show the same trend. Therefore, the results showed that L1 German learners are influenced by their L1 during L2 sentence processing. Yet, the effect was found only in the code-switching version of the experiment (i.e., when English and German sentences alternated), but not in the monolingual mode (see also Hopp, 2017).

Attachment preferences in temporarily ambiguous sentences were also used to investigate the transfer of L1-based processing preferences, but have given mixed results. For example, a relative clause that is preceded by a complex noun phrase can have attachment preferences towards the first noun (NP1) or the second noun (NP2). In (3), the relative clause *who was on the balcony* can refer to NP1 *the sister* or NP2 *the actor* (Dussias & Sagarra, 2007, p. 101). These attachment preferences of the relative clause differ between languages.

(3) An armed robber shot the sister of the actor who was on the balcony.

For instance, English prefers NP2 (low) attachment, but Spanish prefers NP1 (high) attachment. In Dussias (2003), Spanish-English bilinguals were target-like when tested in Spanish and English. Miyao and Omaki (2002) tested L1 Korean L2 Japanese learners and found that the learners used different attachment preferences offline (NP1) and online (NP2). Crosslinguistic influence in attachment preferences was found in eye-tracking, but only with lower-proficient L2 learners (Frenck-Mestre, 1997, 2002). Other studies tested learners with different L1s (e.g., Spanish, German, Russian and Greek), but the results showed no preference to one attachment style (Felser et al., 2003; Marinis et al., 2005; Papadopoulou & Clahsen, 2003).

Because proficiency was found to be another important factor in L1 activation during L2 sentence comprehension, some studies on crosslingustic influence modulated by proficiency will be reviewed. Hopp (2006) investigated the incremental processing of case and number-marking in subject-object ambiguities in 20 L1 English and 20 L1 Dutch advanced learners of German, along with 20 German monolinguals as a control group. A self-paced reading task was in German where the disambiguation of the ambiguous sentences is done either with case on determiners or by number marking on the verb. Reading accuracy revealed no differences between the native speakers and advanced learners that had a lower proficiency, but the RTs in the reading experiment displayed differences between the two groups. The findings show that the high-proficiency non-native speakers (from both L1 groups) patterned like natives during online processing of temporary ambiguities. Moreover, in Hopp (2010) L1 English, L1 Dutch and L1 Russian learners of German were tested on case and subject-verb agreement. Only when the learners were near-native-like in proficiency was there sensitivity to agreement violations, and only with L1 Russian learners whose L1 is highly inflected. Here we can clearly see that the L1 influence was modulated by proficiency.

Some other studies found the effect of proficiency in the use of gender information. For example, in their study on sensitivity to gender marking during spoken-language processing in an eye-tracking experiment, Dussias et al. (2013) found that highly proficient English learners of Spanish used gender information when the context was informative (i.e., there were two objects that differed in gender), compared to low-proficiency English learners of Spanish. This shows that incremental use of gender information was mediated by proficiency, i.e. the effect was present with more advanced learners. In contrast, advanced Italian learners of Spanish used gender predictively, but only for the feminine gender.

In summary, research has found L1 influence mostly at the word level supporting the non-selective activation of languages. Crosslinguistic influence in sentences is also visible, but the results are not as clear as in research on the bilingual mental lexicon. Furthermore, proficiency seems to be a modulating factor in the activation of L1 in L2 sentence comprehension. Research has mostly recorded crosslinguistic influence with learners that have a low L2 proficiency. The current thesis will not focus on L2 proficiency as a main factor, but will investigate under which circumstances the L1 affects L2 processing of English in sentence comprehension. Therefore, proficiency will be taken into consideration while interpreting the results.

1.2.3. Second language acquisition models.

Crosslinguistic influence has so far been seen at the word and sentences level during L2 language processing. Yet, crosslinguistic influence is also predicted by many models of second language acquisition, but the predicted L1 influence depends on different factors in different models. The models I will discuss in this section are some of the key models of L2 acquisition that will serve as an important background for my studies, especially when discussing the results in Chapter 5. This dissertation will not use them as models I would base my predictions on, but I will address them when I present my results. The following paragraphs will introduce L2 models from a generative and usage-based approach.

Studies on L1 influence have been framed within different approaches to L2 acquisition and processing. For example, the generative approach argues that L1 grammar influence will be visible in L2 acquisition, especially in the beginning stages of L2 acquisition. One of the most influential formal approaches is the Full Transfer/Full Access (FT/FA) hypothesis (Schwartz & Sprouse, 1996), which claims that when learners start with the L2 acquisition, they always start with the L1 grammar (Dekydtspotter, Schwartz, & Sprouse, 2006). In other words, the initial state of L2 acquisition is presumed to be identical to the final state of L1 grammatical knowledge, and, in this way, speakers have direct access to linguistic universals. The FT/FA hypothesis mostly looked at L1 transfer in L2 acquisition, however, the same idea was also later applied in L2 online processing as the Full Transfer/Full Access/Full Parse (FT/FA/FP) hypothesis (Dekydtspotter et al., 2006). Contrary to the SSH, the FT/FA/FP hypothesis predicts that learners will not only transfer L1 grammar but also the nature of the parse that derives from the L1 (Rankin, 2014).

Another generative-based approach to L2 acquisition was proposed by Lardiere (2009). Lardiere (2009) introduces the Feature Reassembly Hypothesis (FRH) which also advocates for L1 transfer, similarly to the FT/FA hypothesis, but focuses on L1 feature transfer. The L1 has semantic and morphosyntactic features organized in specific configurations, and precisely this L1 feature configuration is transferred into the L2. The process of L2 acquisition initially starts as the L1 feature configuration but is usually followed by remapping those features into new formal configurations (Shimanskaya, 2015, p. 173). If there are no differences between L1 and L2 feature bundles, the reconfiguration of formal features is not necessary. The remapping process might include removal of certain features from the L1 if the same feature is not present in L2. Furthermore, if there is a feature present in the L2, then that feature has to be remapped or acquired. According to the FRH, feature remapping is what causes variation and challenges during L2 use.

The FRH puts forward two distinct stages in L2 acquisition: (i) the mapping and (ii) the reassembly stage. The mapping stage is a time period, usually in the beginning of the L2 acquisition, when L1 features are associated with the closest equivalents in L2 based on ‘semantic meaning and grammatical function’ (Lardiere, 2009, p. 191). The reassembly stage happens after additional L2 exposure, which leads to the addition of new L2 features not encoded in L1, and reassembling L1 features within the functional categories in L2. This stage can also include abandoning features from the L1 that are not present in the L2. The final stage for learners who reach native-like proficiency would be a stage when they use target-like forms, according to the L2 feature organization. In conclusion, the FRH looks at L2 acquisition from the generative perspective. It advocates for crosslingustic influence through formal feature reassembly from L1 to L2. It looks at L2 native-like proficiency as achievable if the learners advance to the final stage, by going through the mapping stage and the feature reassembly stage.

Crosslinguistic influence was also explained with usage-based models. As opposed to the generative approach, usage-based models argue that language learning is a part of a universal mechanism that is not specific to languages (Ellis & Wulff, 2015). One of the major construct of usage-based approaches is associative language learning, which claims that the more reliable the form and meaning association is, the easier it should be for the learner to learn the construct (Ellis & Wulff, 2015). In other words, if a cue is more reliable, it is learned more quickly and readily.

In English, for example, tense can be encoded morphologically, e.g. adding *–ed* for events happening in the past (*worked)*, or lexically, e.g. using a temporal adverbial *yesterday* to signal past events. Ellis and Sagarra (2010b) note that English uses prepositional phrases (e.g., *in the evening*), calendric reference (e.g., *in April*) or serialization (e.g., *I woke up, brushed my teeth and got dressed*) to locate events on a timeline. A usual pattern in L2 acquisition of temporality is that learners start with serialization (i.e., chronological order), then move to lexical cues and finally morphological cues (Bardovi-Harlig, 2000; Ellis & Sagarra, 2010b, 2010a). However, some languages, like Mandarin Chinese, do not have grammatical means of expressing tense. This variation in the encoding of information across languages could potentially affect further acquisition of L2. Moreover, in order to be successful, learners should be able to not only shift their attention to meaning and form, but to also make form-meaning connections, i.e. the associations between forms like determiners and their meaning (Ellis & Sagarra, 2010a).

Lexical cues are more salient and easier for adult learners for several reasons. First, a temporal adverbial (e.g., *yesterday*) is more salient than the *–ed* inflection on the verb. Because inflectional endings are frequent in everyday use and they are not as salient, they are not reliable cues in language use (2010a). Ellis and Sagarra (2010a) argue that the learner experience has an important role in the process of L2 acquisition. When a person learns to rely on a specific cue which conveys a specific information, internalizing an additional cue which conveys the same information in a different manner is a difficult task for the learner (Kamin, 1969; Kruschke & Blair, 2000). Language experience, be it in L1 or L2, consists of these tasks, and those language experiences in L2 acquisition are called *learned attention*. Therefore, learned attention describes the process of learning additional cues in the L2 for the same or for novel linguistic concepts.

For example, temporal adverbs convey where on the timeline an event is located, but the same can be expressed with morphological inflections. Internalizing additional cues for signaling the time of an event proves to be more challenging for learners (Kamin, 1969; Kruschke, 2006; Kruschke & Blair, 2000). In the beginning, L2 learners are able to focus only on one cue (MacWhinney & Bates, 1989; VanPatten, 1996). Only in the later stages does learners' experience have an effect. For example, adult learners of a L2 might be aware that there is an array of cues available, and that some of them are more or less reliable, redundant and/or salient. The L1 experience, i.e. relying on cues that are present in L1 for a specific phenomenon (e.g., tense), will block other L2 cues that are usually not part of the L1 experience. Therefore, the learner has to shift attention to additional cues in the L2 and retune learned attention with sufficient exposure to match the L2 cues (Bardovi-Harlig, 1992; Bordag & Pechmann, 2007). If the two languages are similar enough, the L1 can help the process of L2 acquisition, due to the similarity of cues used to convey a certain information (Costa, Kovacic, Franck, & Caramazza, 2003; Jiang, 2004; Tokowicz & MacWhinney, 2005). For instance, the L1 can be a factor in the reliability of morphological cues in L2.

In summary, learners will be affected by (i) the L1 experience and (ii) saliency and reliability of cues. The results of the studies by Ellis and Sagarra (2010b, 2010a) show that, overall, L2 learners have a tendency of relying on lexical cues in the beginning stages of acquisition, but, also, that L1 has an effect on the choice of cues during the process, in line with other studies which argue for L1 influence (Frenck-Mestre, 2005; Hopp, 2007; Tokowicz & MacWhinney, 2005). The following section will cover general predictions of the dissertation from either a generative or usage-based perspective and discuss the reasoning behind using different L1s.

1.3. Summary and research questions

The current dissertation uses three separate online experiments to test if there is crosslinguistic influence in L2 sentence processing. The general hypothesis is that learners'

L1 will affect their L2 processing, which will be seen as crosslinguistic influence. There are three studies altogether—one for each topic, i.e. grammatical gender, grammatical aspect and present perfect tense. L1 influence will be tested with L2 English learners with different L1s, namely, Croatian, Spanish and German. These L1 languages were systematically chosen based on how they realize gender, tense and aspect, compared to other L1s and compared to L2 English. The reason for testing different L1 populations is to disentangle possible L1 effects in L2 processing. For example, Croatian, Spanish and German differ in how grammatical gender, present perfect tense and grammatical aspect are realized (Table 1). Even though grammatical gender is present in all L1s, it has a binary distinction in Spanish (i.e., masculine and feminine) and a ternary distinction in Croatian and German (i.e., masculine, feminine and neuter). English, on the other hand, does not instantiate grammatical gender. Present perfect tense in English has an equivalent tense in form and meaning in Spanish, but Croatian and German have a present perfect tense that has a preterit meaning. Finally, grammatical aspect is not present in German, but aspect is grammaticalized in Croatian, Spanish and English. However, while English grammaticalizes the progressive/simple distinction and Croatian expresses the perfective/imperfective distinction, Spanish realizes both progressive/simple and perfective/imperfective distinction. These grammatical differences are crucial in order to test which factors are prevalent in crosslinguistic influence in L2 sentence comprehension.

Table 1. Crosslinguistic differences examined in this thesis between L1s (Croatian, Spanish and German) and L2 English

	L2		L1	
	English	Croatian	Spanish	German
Grammatical gender	–	+	+	+
Present perfect	+	–	+	–
Grammatical aspect	+	+	+	–

Therefore, the general question of the study is as follows: Do L2 learners of English co-activate L1 morpho-syntactic information during L2 online processing? The second question is: which factors modulate crosslinguistic influence in L2 sentence processing? The current study hypothesizes that L2 learners will activate L1 information during sentence processing of L2 gender, tense and aspect. Chapter 2, Chapter 3 and Chapter 4 will cover more specific research questions and their predictions in more detail. By using different approaches to L2 acquisition and processing, the study can also test different predictions.

The SSH claims that L2 learners underuse syntactic information during online sentence processing. The hypothesis only claims that learners will, on average, rely more on lexical and discourse information during L2 processing, rather than use structural information to predict the upcoming input. Based on this hypothesis, regardless if the L2 learners has Croatian, Spanish or German as their L1, they will not be able to show native-like sentence processing. Therefore, the SSH would not directly predict crosslinguistic influence in sentence comprehension nor any difference between L2 learner groups on gender, aspect and tense.

The FRH, on the other hand, claims that where there are differences between L1 and L2 grammatical representations, learners will have to reassemble feature configuration of the L1 in order to match the feature configuration of the L2. This includes, first, mapping existing L1 features to the closest L2 equivalent, later reassembling them (if necessary) and potentially abandoning some old features or adding some new features. Because all three languages differ in their realization of gender and aspect, we are expecting to see differences between them when it comes to L2 sentence processing. As for tense, Spanish has the same form and meaning for past tenses as English, so no crosslinguistic influence is predicted in the case of L1 Spanish group.

Learned attention focuses on the L1 and L2 experience, and looks at which types of cues L1 uses for specific phenomena and also if the increased exposure to L2 changes the learner's attention to the type of cues. The difference between languages might not be apparent with grammatical gender, as all L1s have biological gender and express it on pronouns. There should be no differences in tense and aspect because in their L1 and L2 learners use morphosyntactic cues to express present perfect tense and progressive aspect, except for the L1 German group whose L1 lacks grammatical ways of expressing aspect.

Thus, different theories make different predictions regarding topics of grammatical gender, grammatical aspect and present perfect tense in L2 sentence processing. The aim of the current dissertation is to explore potential crosslinguistic influence regarding lexical-syntactic information and to interpret the results based on different approaches to L2. More detailed research questions, hypotheses and predictions based on previous research will be described in chapters on individual experiments. The following chapter will introduce the first experiment on the topic of L1 grammatical gender influence in L2 sentence processing of English.

2. Study 1: Grammatical Gender

2.1. Introduction

The bilingual mental lexical has been a topic of research for the last few decades, with studies mostly arguing for the non-selective lexical access (Dijkstra & Van Heuven, 2002; Dijkstra et al., 1998; Van Heuven et al., 1998). Based on the non-selective view, i.e. the activation of word representations from both L1 and L2, bilinguals store words in an integrated lexicon, and regardless of the language in use, words from both the L1 and the L2 are considered for retrieval. However, the representation and processing of grammatical gender in the mental lexicon is still not clear. Although there have been some studies on gender activation in bilinguals, they mostly focused on language production in isolation (Bordag & Pechmann, 2007; Morales, Paolieri, & Bajo, 2011; Paolieri et al., 2010) and showed mixed results especially regarding Romance languages in word production (Costa et al., 2003).

This chapter will focus on grammatical gender, a phenomenon defined as the classification of words onto lexical classes (Corbett, 1991). The allocation of nouns to grammatical genders has been defined as arbitrary, language-specific and in certain languages phonologically transparent when it comes to nouns' endings (Corbett, 1991). Following the language non-selective view that was supported by studies at a level of semantic (conceptual) representations (Costa, Miozzo, & Caramazza, 1999; Kroll & Stewart, 1994) and at a lexical (form) level (Groot & Nas, 1991), research on the representation of grammatical gender has also found that L1 gender information is activated during L2 comprehension and production (Lemhöfer, Spalek, & Schriefers, 2008). Studies on gender representation have given support for *gender-integrated representation hypothesis* (Salamoura & Williams, 2007). This hypothesis refers to bilinguals having one set of shared nodes between the L1 and the L2. However, the *gender autonomous representation hypothesis* (Costa et al., 2003) argues for two sets of separate language-specific nodes. The results of the studies seem to vary on the number of gender values and also on the type of task learners are presented with (i.e., production vs. comprehension).

The study at hand looks at L1 gender activation in an L2 context where grammatical gender information is irrelevant. This phenomenon is also known as 'transfer to nowhere', whereby the L1 feature is nonexistent in the L2, but still gets transferred. The study builds on previous research by (Conklin et al., 2007) that tested adult Dutch L2 English learners and found that they activated Dutch gender when listening to sentences in English. Critically, cross-linguistic activation was limited to sentences with cognate nouns (e.g., *tractor*). In this study I report Experiment 1 with proficient adult L1 German L2 English learners, which is based on the Dutch-English experiment, and I look at online processing of anaphora resolution in English as a L2 during eye tracking. The lack of evidence for the activation of L1 German gender information in Experiment 1 led to a change in the experiment, this time presenting the items in a language mixing context in order to heighten the top-down activation of L1 grammatical gender in Experiment 2. What is more, the study also looks at three L1s with different realizations of grammatical gender, namely Croatian, Spanish and German. The results give some support for the non-selective access and gender-integrated representation in the bilingual lexicon, however, this is conditioned by the level of L1 activation, the lexical overlap and the type of gender value realization in the L1.

2.2. The bilingual mental lexicon

Studies on the activation within the bilingual lexicon mostly focused on investigating whether words from different languages are stored in either one integrated lexicon or in two separate lexicons (Gerard & Scarborough, 1989; Macnamara, 1971; Scarborough, Gerard, & Cortese, 1984; Soares & Grosjean, 1984). In terms of lexical interactions in the bilingual lexicon, many studies have used cognates and interlingual homographs (false friends) (Lemhöfer & Dijkstra, 2004; Schwartz & Kroll, 2006). Cognates are words that share the same meaning and have a similar (or the same) orthographic form (e.g. *nest*$_{\mathrm{ENG}}$ - *Nest*$_{\mathrm{GER}}$). Because they overlap on several levels in different languages, they are a perfect tool for testing if words are stored in a shared lexicon or not. If cognates are retrieved or processed faster than noncognates (i.e., pure translations), then this effect would argue for the language-integrated nature of the lexicon. Such a facilitation effect is referred to as the *cognate facilitation effect* (Dijkstra & Van Heuven, 2002). In contrast, interlingual homographs are words that share the same form across languages but differ in meaning, and they may be usually processed/produced more slowly (Titone et al., 2011) because the word has to be associated to a languages in order for the correct meaning to be retrieved. For instance, an example of a false friend is a noun *rock* in English and ‘Rock’ (*skirt*$_{\mathrm{GER}}$) in German, words which have different meanings, even though they are written in a similar way. This so-called homograph inhibition effect would also support the language-integrated lexicon by showing simultaneous non-selective lexical activation of both L1 and L2.

The cognate facilitation effect was found in L2 word production (Dijkstra, Grainger, & Van Heuven, 1999), in that cognates were: translated faster (Groot, Dannenburg, & Van Hell, 1994), named faster in word naming (De Groot, Borgwaldt, Bos, & Van Den Eijnden, 2002), and named faster in picture naming (Costa, Caramazza, & Sebastián-Gallés, 2000) in comparison to pure translations and interlingual homographs. The same cognate effect was also present in L1 processing (Van Hell & Dijkstra, 2002; Van Wijnendaele & Brysbaert, 2002) in that cognates elicited faster RTs than pure translations. Not only is cognate facilitation effect present in bilinguals, but could also be seen in trilinguals (Lemhöfer et al., 2004; Van Hell & Dijkstra, 2002). Other studies found that the cognate facilitation effect can be affected by neighborhood size, word frequency and word length (Van Hell & Dijkstra, 2002). Interlingual homorgraphs had the opposite effect of cognates in studies, where they either showed slowdowns in RTs or no difference between monolingual words (Dijkstra et al., 1998; Lemhöfer & Dijkstra, 2004).

Bilingual word recognition is also affected by the context of the sentence (Altarriba, Kroll, Sholl, & Rayner, 1996). When it comes to the activation of cognates in a sentential context, Schwartz and Kroll (2006) also found the cognate facilitation effect for Spanish-English bilinguals, but only in low-constraint sentences. In low-constraint sentences, the sentence context is not enough for reliable prediction of the final word (*Sarah returned earlier from work because she forgot the* _______), opposed to high constraint sentences where the final word is more predictable (*Because Mallorca is so hot during the summer, many people go to the* _______). The fact that the cognate facilitation effect was not visible in high-constraint sentences suggests that sentence context can be a factor in modulating lexical access. Studies that use lexical decision tasks or naming tasks (Schwartz & Kroll, 2006; van Hell & de Groot, 2008) found that a strong context (i.e., high-constraint context) eliminates the cognate facilitation effect. Yet, a study by Duyck, Van Assche, Drieghe, and Hartsuiker (2007), found the cognate facilitation with nouns in an eye tracking study even with high-constraint sentences containing cognates in the middle of the sentence. The effect was only found for identical cognates in early reading times, which means that the cognate facilitation effect might be affected by context, but does not inhibit the non-selectiveness of languages even in strong semantic contexts.

Language dominance is another factor that has to be taken into consideration during lexical activation. A language that is dominant is usually a language of the country and the education in heritage speakers, but for all bilinguals it is usually a stronger language (Montrul, 2010). In an eye tracking study by Blumenfeld and Marian (2007), it was shown that dominance modulates language co-activation. The participants were late bilinguals who were chosen only if they rated themselves high (at least 3 on a 5-Likert scale) on L2 proficiency and if they had been immersed in the L2 context for at least six months. They listened to a word in English that was either a cognate with a German word or not, and they had to choose the picture of an object that matched the word meaning in English. Only bilinguals who had German as their dominant language activated the language while hearing English monolingual words during eye tracking. English-dominant bilinguals activated German only in the context where cognates were used. Other studies have replicated the effect, namely, that listeners activated even a less proficient language when processing cognates (Marian & Spivey, 2003b, 2003a; Andrea Weber & Cutler, 2004).

So far, studies on bilingual lexical access have used cognates as primary evidence for support of the integrated lexicon in both bilinguals and trilinguals (Lemhöfer et al., 2004). This study, however, goes beyond the scope of lexemes (i.e., orthographic or phonological word form information), and looks at other features at the lemma level in the mental lexicon, such as grammatical gender. Even though there has been much research on the architecture of the mental lexicon in monolinguals and bilinguals, it is not yet clear how grammatical gender is represented and when it becomes available in lexical access. The next section will cover representational models of monolingual and bilingual lexical access in word production and recognition, and will look at the representation of the gender feature.

2.2.1. Representational models of lexical access.

Words in the mental lexicon are accessed differently in word production and word recognition. When a word is pronounced, we first access the concept and then move onto other stages until we reach the specific phonological contour needed for production. As opposed to the top-down nature of the word production process, the input in word recognition is bottom-up, as the first information one encounters is the phonological information in spoken and grapheme information in written recognition. For these reasons, models of lexical access tried to account for either word production or word recognition, and we first need to understand how the individual processes function in order to put forward a model that encompasses both.

2.2.1.1. Word production.

As already stated, word production models tried to account for top-down activation, i.e. first activating conceptual, later lexical, and finally phonological information (Dell, Schwartz, Martin, Saffran, & Gagnon, 1997; Levelt, 1993; Levelt, Roelofs, & Meyer, 1999). One of the most influential monolingual speech production models, *WEAVER++* (Levelt et al., 1999; Roelofs, 1992), illustrated in Figure 1, displays the following stages: lexical concepts, lemmas, morphemes, phonological words, and phonetic gestural scores (Levelt et al., 1999, p. 3). The bottom layer is concerned with the phonology of the words, the upper one with the meaning, and in between the gender information is stored via nodes, along with other syntactic information. According to this model, the first information that gets activated is semantic information, which in turn activates the intermediate *lemma* level, and only in the end phonological information gets selected. In terms of gender, the information is presumed to be automatically activated at the lemma level, and because it is a part of the syntactic procedures, it is only selected during gender agreement.

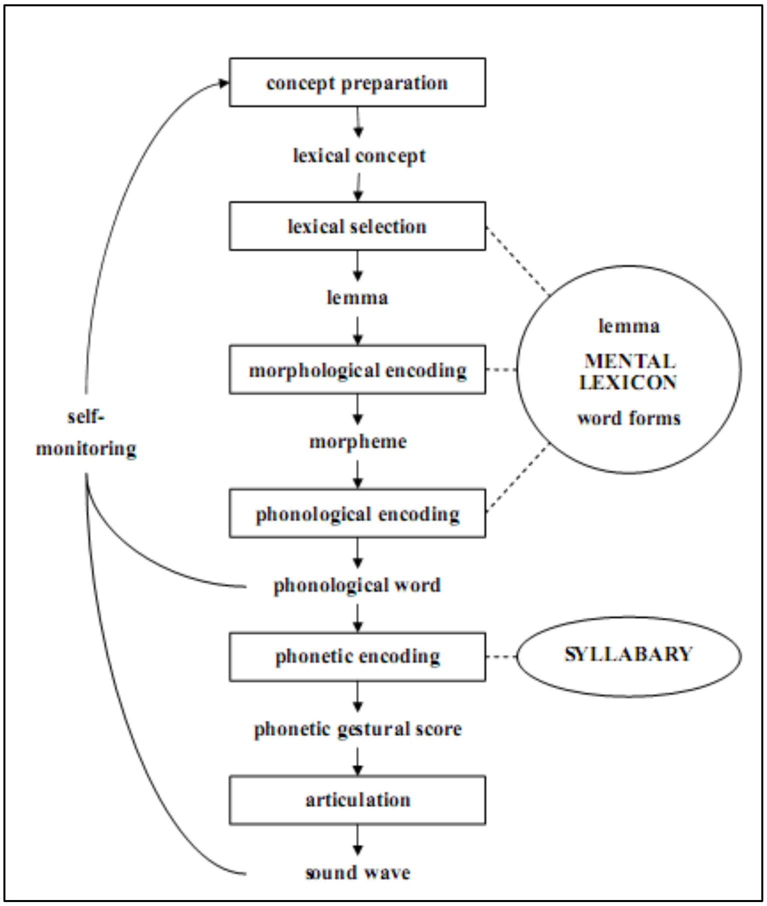

Figure 1. The WEAVER++ model of spoken language production (Levelt et al., 1999)

Another monolingual model, the *Independent Network model* (Figure 2), has three strata that interact with one another: semantic, syntactic and lexeme information (Caramazza, 1997). It also represents both orthographic and phonological forms that are only activated in contexts when they are required (e.g., orthography for written stimuli). Moreover, it allows for the simultaneous activation as the semantic stratum also has a direct link to the lexeme stratum. According to the model, gender information is stored at the syntactic level via gender nodes (Roelofs, 2008). The *Independent Network model*, similarly to *WEAVER++*, argues that gender is only selected in those situations where gender agreement is required; therefore, grammatical gender will be absent, e.g. bare noun production (Caramazza & Miozzo, 1997).

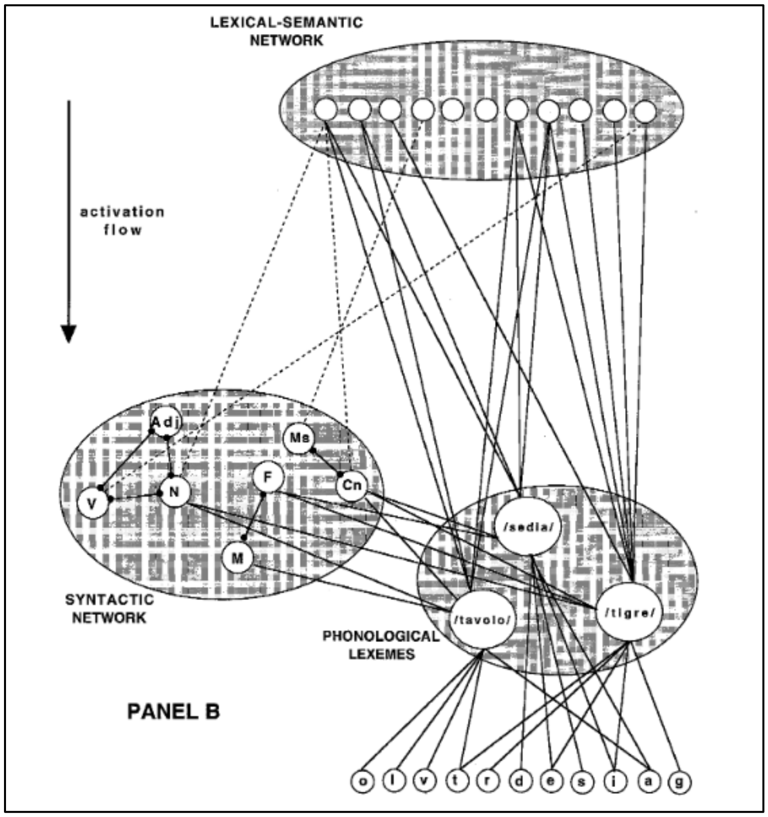

Figure 2. The *Independent Network model* of spoken language production (Caramazza, 1997)

In contrast, the *interactive two-step model* (Dell et al., 1997), very similarly to WEAVER++, has the same three levels (i.e., semantic, lemma and phoneme). However, the model allows for bottom-up and top-down activation (Figure 3). Gender information is also believed to be a lemma feature.

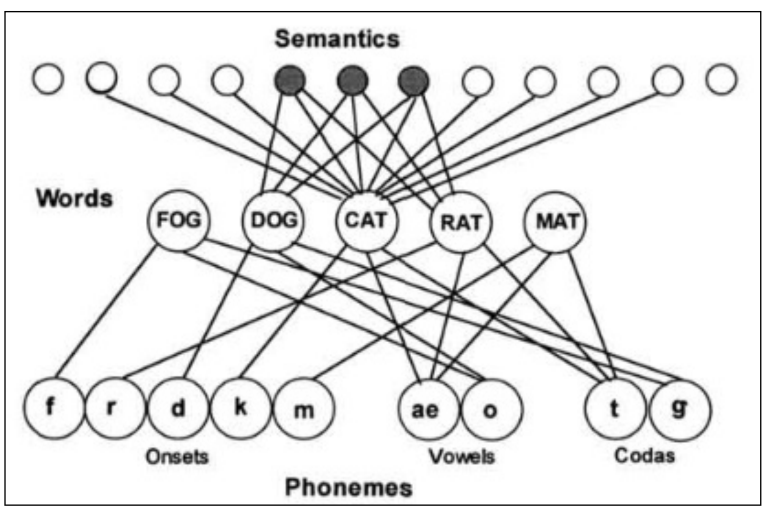

Figure 3. The *interactive two-step model* of spoken language production (Dell et al., 1997)

Because in the *Independent Network model* there are also inhibitory notes in the syntactic network, that excludes the possibility of competition between genders. For this reason, Schiller and Caramazza (2003) proposed the *determiner selection interference hypothesis* that states that gender competition only takes place during determiner activation. Therefore, it is not the selection of gender nodes that leads to gender congruency effects, but rather the selection of the determiners (Schiller & Caramazza, 2003). In languages such as German, by activating the word, grammatical gender is automatically retrieved, along with the determiner. In contrast, languages like Spanish depend on phonological information. For example, when nouns in Spanish beginning with a tonic vowel 'a', instead of selecting the feminine default gender, masculine gender is selected (*el*$_{\text{MASC}}$ *agua*$_{FEM}$). This implies that, because phonological information has to be accessed, the process of determiner selection is delayed.

So far, monolingual models of word production have mostly focused on lexical, syntactic, semantic and phonological information, but haven't explored the representation of grammatical gender system in the mental lexicon in more detail. When it comes to bilingual speech production, de Bot (2004) updated Levelt's (1993) *speaking model*, which was the initial model from which WEAVER++ later developed, and added a language and a gender node. The *multilingual processing model* (de Bot, 2004) states that target language activation is language specific, i.e. the target language node has to be selected at the conceptual level, but because certain aspects may overlap with other languages (e.g., gender values or phonology), it is possible for non-target language to get activated as well (Figure 4). Therefore, the first stage of the model is the conceptual information where the features may be shared between languages (e.g., representing the same meaning), followed by the lemma stage that will provide information for the syntactic procedures, such as grammatical gender.

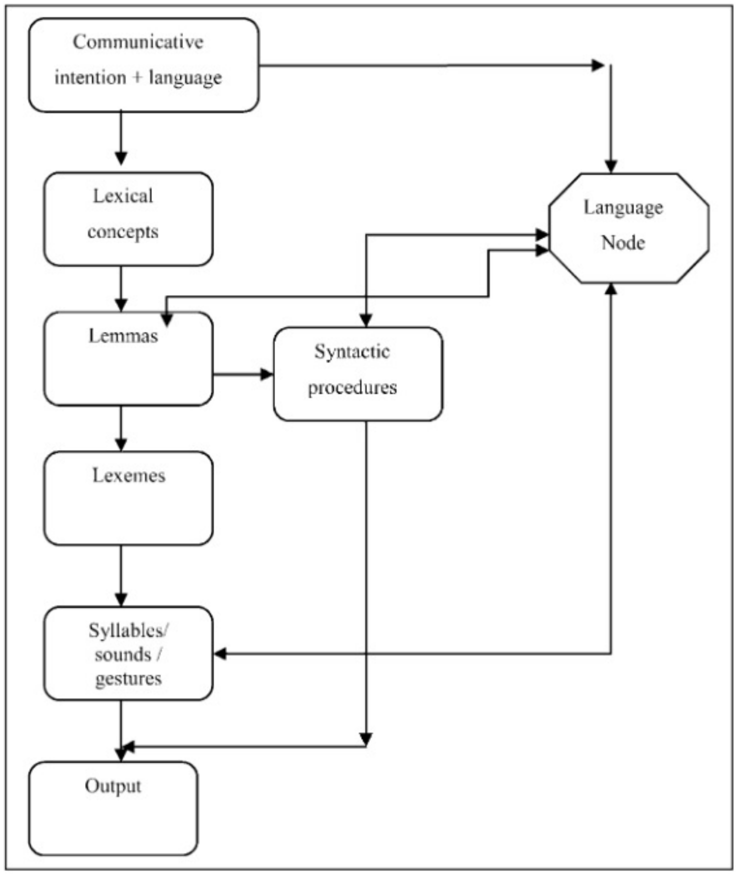

Figure 4. The *multilingual processing model* of spoken language production (De Bot, 2004)

Research on spoken word production has put forward models for monolingual and bilingual mental lexicon. Aside from their focus on conceptual and phonological information, there is not much emphasis on the representation and activation of gender. In WEAVER++ and the *interactive two-step model*, gender is located at the lemma level, and in the *independent network model*, gender is syntactic information. When it comes to bilingual spoken word production models, in the *multilingual processing model* gender is presumed to be stored as at the lemma level which later activates syntactic procedures. The following section will cover the most prominent models of word recognition and how they represent grammatical gender information.

2.2.1.2. Word recognition.

As already mentioned, the difference between word production and word recognition is the order of information activation. In word recognition, phoneme or grapheme information is accessed first which then activates semantic and syntactic information, which is where gender becomes relevant. Therefore, during bottom-up processing (i.e., word recognition), grammatical gender is activated at later stages. The following models outline how word recognition processing takes place in a mind of a bilinguals.

The *Interactive Activation Model* (IAM) of visual word recognition by McClelland and Rumelhart (1981) is a connectionist model which argues for parallel processing within and between levels. There are three levels (i.e., visual features, letters, and words) that get accessed and interact (Figure 5). As the language user encounters more information, by using the process of elimination, the target words will be chosen among the competitors. The inhibition effect of orthographic neighbors was observed within-language and between-languages (Bijeljac-Babic, Biardeau, & Grainger, 1997).

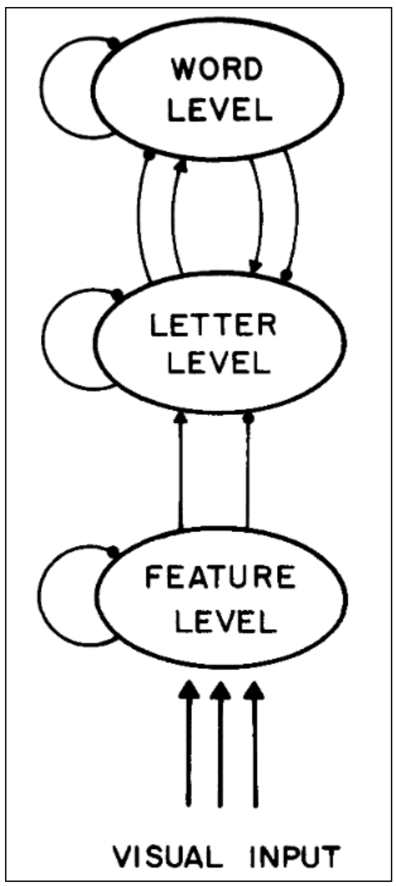

Figure 5. The *Interactive Activation Model* of written word recognition (McClelland & Rumelhart, 1981)

Around two decades ago, lexical access during word recognition started being a topic of research for many studies. A study by Heuven, Dijkstra and Grainger (1998) found that the more orthographic neighbors a word has in L1, the slower reaction times (RTs) for L2 word recognition will be. Aside from the orthographic neighborhood effect, a study by Dijkstra, Timmermans and Schriefers (2000) showed that words that exist in both Dutch and English, but differ in meaning (i.e., interlingual homographs) were recognized more slowly than non-homographs. This led Dijkstra and Van Heuven (2002) to create a model called the *Bilingual Interactive Activation model* (BIA) (Figure 6). The model is similar to IAM, however, it differs in the assumption that words from different languages are stored together, supporting the language non-selective access (i.e., activation of candidates in both languages) when it comes to word recognition. According to the model, when the word is presented, the visual features activate the letters that share the same features (Dijkstra & Van Heuven, 2002, p. 176). Other letters that do not share the features are inhibited, and as a consequence, word candidates from both languages are activated at a lexical level. The same inhibition process will occur, this time at a word level, with activated words inhibiting words from both languages. The language nodes get selected by the activated words, which not only act as tags, but also as inhibitory nodes for the irrelevant language. The level of language node activation reflects how much each language is activated in the mental lexicon.

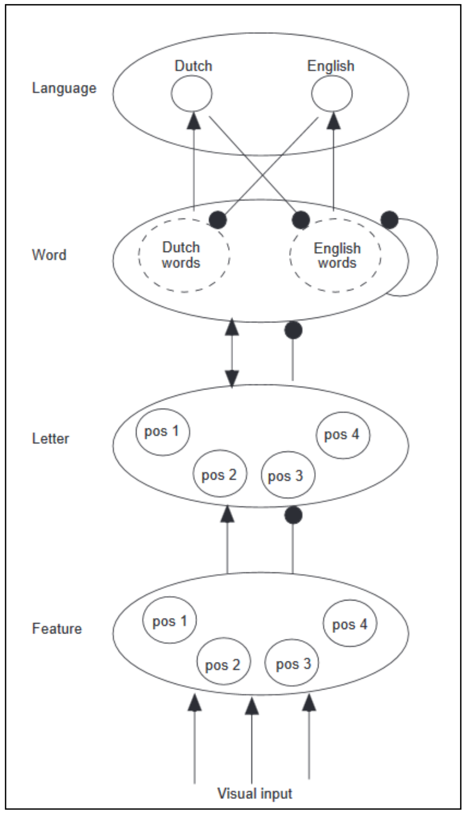

Figure 6. The *Bilingual Interactive Activation* (BIA) model for bilingual word recognition (Dijkstra & Van Heuven, 2002, p. 177; Dijkstra et al., 1998)

The updated *Bilingual Interactive Activation Plus* (BIA+) model (Dijkstra & Van Heuven, 2002) makes a distinction between a *word identification system* and a *task schema system* (Figure 7). The word identification system deals with the linguistic process during word recognition, while the task schema system tries to explain non-linguistic factors such as task focus, instruction, and participant expectancies (Brysbaert & Dijkstra, 2006). In the word identification system, phonological/orthographic features activate word candidates in both L1 and L2, and languages nodes serve as representational features, but they also may aid the word recognition by inhibiting the language that is not the target language. The model received support from many studies on cognate processing in isolation (Dijkstra et al., 1999; Dijkstra, Miwa, Brummelhuis, Sappelli, & Baayen, 2010; Dijkstra & Van Heuven, 2002; Lemhöfer et al., 2004; Van Hell & Dijkstra, 2002) and in a sentence context (Duyck et al., 2007; Schwartz & Kroll, 2006; Van Assche et al., 2010) with cognates being recognized faster than pure translations. Even though the model does focus on grammatical gender, in the study (Dijkstra & Van Heuven, 2002) it is mentioned that gender system should be represented at the lemma level, along with other syntactic information, in the form of gender nodes. However, no specifics about the selection of the gender information are given.

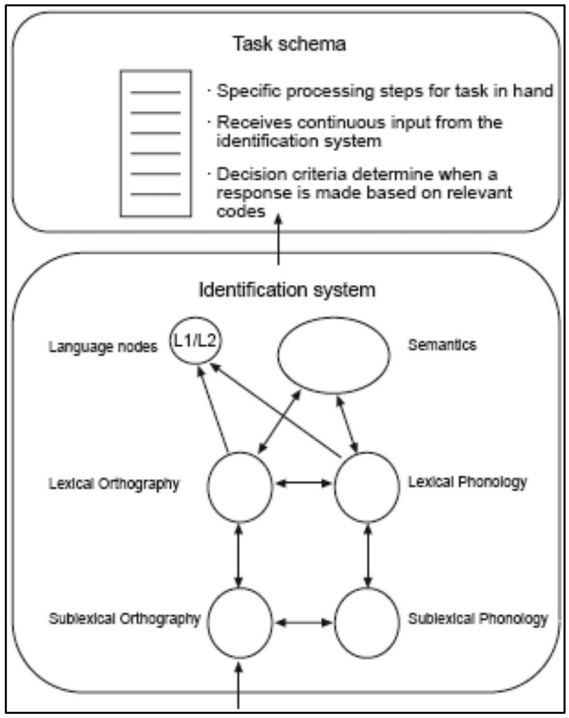

Figure 7. The *Bilingual Interactive Activation Plus* (BIA+) model for bilingual word recognition (Dijkstra & Van Heuven, 2002, p. 182)

Both the BIA and the BIA+ models assume that when a word is activated, all of its orthographic and phonological competitors will also be activated, and together with them, their semantic representations. None of these models, however, makes a direct prediction when it comes to processing gender information during word recognition. Yet, the research that served as a basis for word production and recognition models made it possible to predict where exactly the gender nodes are presented in the mental lexicon and how they can potentially get activated.

2.2.1.3. Grammatical gender in bilinguals.

Even though there are no clear models that clearly state how gender information is represented in a bilingual lexicon, there are two ways researchers approached the topic. One way is to argue that gender nodes are language autonomous (Kroll & Stewart, 1994) or that the gender nodes are shared between the L1 and the L2 (Groot, 1992). This leads us to two hypotheses that have been put forward: the *gender autonomous* (Costa et al., 2003) and the *gender integrated hypothesis* (Salamoura & Williams, 2007). Production studies have given evidence for both hypotheses.

The *gender-autonomous representation hypothesis* (Costa et al., 2003) states that L1 and L2 have two separate gender systems. This means that if a word such as 'hammer' (*Hammer*$_{\text{MASC}}$) in L1 German gets activated, its corresponding masculine L1 gender node at the lemma level would be activated as well. The word 'hammer' (*čekić*$_{\text{MASC}}$) in L2 Croatian also has masculine gender, but the gender node that would get activated will be L2-specific and would not be shared between L1 and L2 (Figure 8). Therefore, no facilitation is expected if gender nodes are autonomously represented in the mental lexicon.

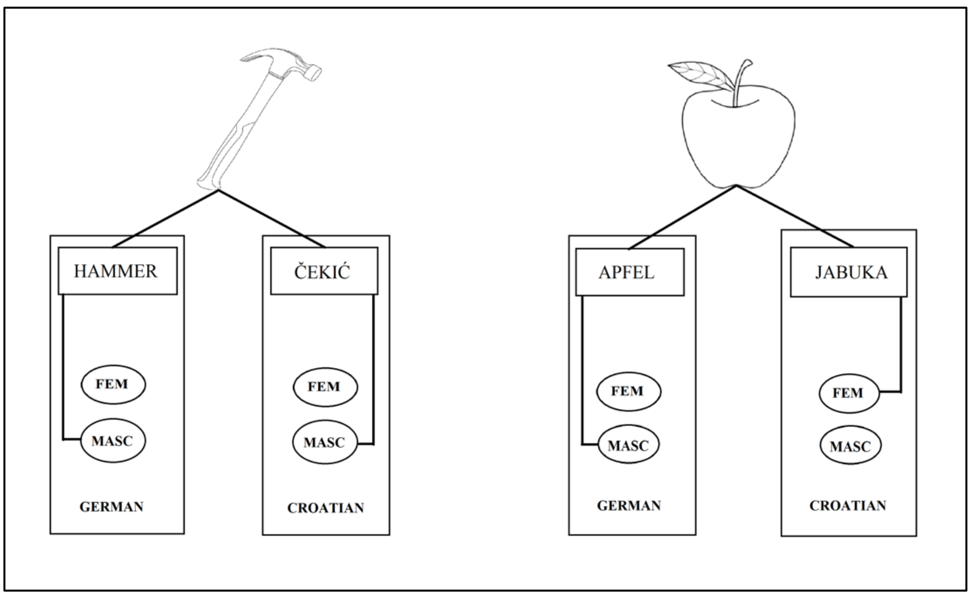

Figure 8. The *gender autonomous representation hypothesis* (Costa et al., 2003) for gender congruent (left) and gender incongruent (right) nouns (adapted from Costa et al., 2003)

The *gender-integrated representation hypothesis* (Salamoura & Williams, 2007) states that nouns share the same set of gender nodes. For example, because 'hammer' in German and Croatian are both masculine nouns, they will share the same masculine gender node. This means that the fact that the two nouns in L1 and L2 share the same gender will activate the same gender node and will have an additional activation from both L1 word and L2 word translation. This increased activation will produce facilitative effects in production for nouns matched in gender (i.e., gender congruent), which is also a phenomenon called the *gender congruency effect*. Nouns that do not match in gender (i.e., gender incongruent), like 'apple' in German (*Apfel*MASC) and Croatian (*jabuka*FEM) will have two competing gender nodes that will inhibit the response (Figure 9). Therefore, the gender-integrated representation hypothesis states that congruent nouns will be translated and produced faster than incongruent nouns.

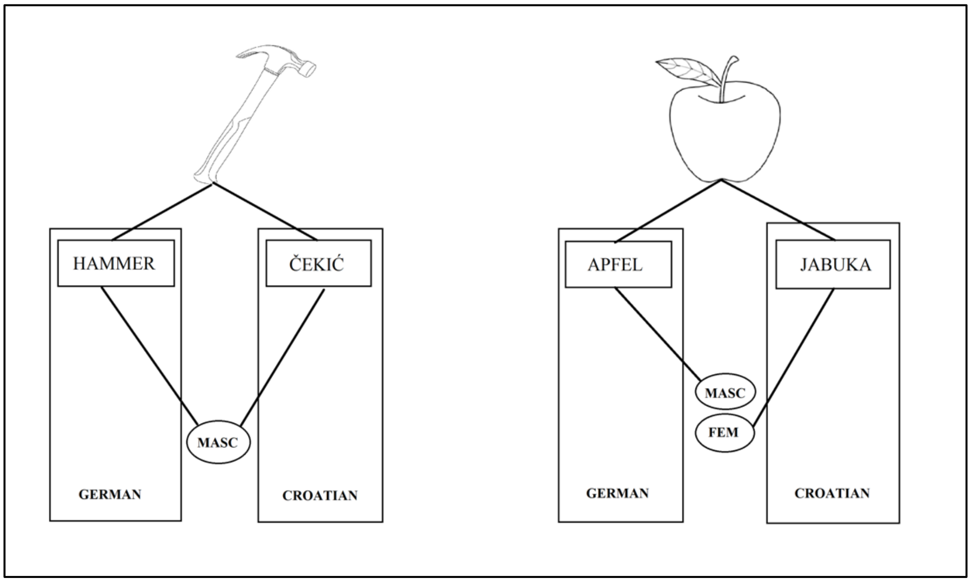

Figure 9. The *gender integrated representation hypothesis* (Salamoura & Williams, 2007) for gender congruent (left) and gender incongruent (right) nouns (adapted from Costa et al., 2003)

One of the first studies that argued for gender-integrated representation was a study by Schriefers (1993) which used a picture-word interference task (i.e., naming objects that are presented with distractor words as quickly as possible). The study first introduced the *gender congruency effect* with longer naming latencies for naming pictures which have a distractor word of a different gender (incongruent condition), than for words that share the same gender (congruent condition). The effect was later explored in both monolingual and bilingual studies, however, in bilingual studies the manipulation was between L1 and L2 translation genders in order to explore the representation of the gender system.

Klassen (2016a) looked at how languages with asymmetric gender systems like Spanish and German represent gender in the mental lexicon. Klassen (2016a) proposes that the gender values that are existent in both L1 and L2 have a single set of nodes. Language specific gender values are stored separately in the lexicon and are not as affected by the activation of shared gender nodes (Figure 10). This means that if L1-L2 words that share the gender value are activated, the fact that the gender node is shared will facilitate the production of the L2 noun. When the L1-L2 words do not share the same gender value, interference will take place which would slow down the process of word production. When the L1-L2 words do not share the same value, but also the L2 value is L2-specific, the interference effect will not be as visible considering that the words do not share the same gender node. Therefore, the interference effect will be reduced. In the case of languages that do not share a gender value, such as Dutch (common and neuter) and Spanish (masculine and feminine), Klassen (2016a) proposes separate storage of gender nodes, similar to the *gender autonomous representation hypothesis* (Costa et al., 2003).

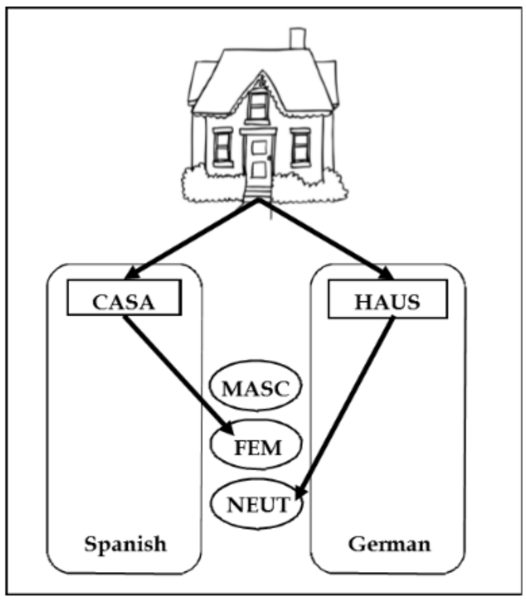

Figure 10. The gender representation of 'house' in Spanish-German bilinguals who have languages with asymmetric genders (Klassen, 2016a, p. 184).

In the following, grammatical gender will be described in more detail. Moreover, the realization of gender assignment and gender agreement will be discussed specifically for Croatian, German and Spanish languages.

2.2.2. Grammatical gender feature.

Gender is one way of classifying nouns and it may vary across languages. For example, the word *apple* is feminine in Spanish (*manzana*$_{\text{SPA}}$) and masculine in German (*Apfel*$_{\text{GER}}$). Differences in gender systems across languages usually concern the number of gender values, how closely grammatical gender is linked to the biological gender and the transparency of the gender of a noun.

Gender systems can be distinguished between *semantic gender* and *grammatical gender* (Corbett, 1991). Semantic gender makes a distinction between male and female animate referents and it refers to their biological gender. In English, for example, the pronouns *he* and *she* are used to differentiate between male and female referents. Additionally, the biological gender can also be expressed by stating the sex of a referent (*boy/girl*, *actor/actress*). Grammatical or formal gender has no connection with the sex of the referent and it classifies inanimate nouns into different categories. In this case, the classification is not dependent on the meaning of the noun (Corbett, 1991), but may be determined by phonological/morphological information or it could also be arbitrary (Cook, 2018). The number of grammatical gender values can differ among languages (e.g., two or more values), or the feature can also be absent, as it is the case with English.

Another important distinction to be made is between *gender assignment* and *gender agreement*. Gender assignment denotes classifying a word to one of the gender values. For example, in Croatian, words can have masculine, feminine or neuter gender, and the noun 'apple' (*jabuka*$_{\text{FEM}}$) is categorized as feminine. Gender agreement refers to the process of changing the form of certain elements in a sentence (e.g., adjectives, articles, pronouns) so that they reflect the gender that was assigned to the noun (Carstens, 2000). In Croatian, the adjective agrees with the gender of the noun, and therefore the noun phrase 'red apple' in Croatian would be *crvena*$_{\text{FEM}}$ *jabuka*$_{\text{FEM}}$, but 'red table' would be *crven*$_{\text{MASC}}$ *stol*$_{\text{MASC}}$. This shows that, in Croatian, adjectives take a different form depending on the gender of the noun (i.e., masculine, feminine or neuter). Therefore, when we talk about gender assignment, we talk about the mental lexicon; however, gender agreement refers to the morpho-syntactic level because it includes other constituents in a sentence or phrase that change in form depending on the gender of the noun.

L2 studies have found that learners whose L1 instantiates grammatical gender also activate L1 gender while they are processing L2 grammatical gender. The evidence of L1 gender activation was mostly observed with picture naming studies (Morales, Paolieri, & Dussias, 2016; Paolieri, Padilla, Koreneva, Morales, & Macizco, 2018). Participants were presented with a series of pictures and were asked to name the picture in the target language. The names of the picture in L1 and L2 either differed or overlapped in gender. When two nouns share the same gender across languages, like 'apple' in Croatian (*jabuka*$_{\text{FEM}}$) and

Spanish (*manzana*$_{\text{FEM}}$), then they are called *gender-congruent*. However, when the two nouns differ in gender, like 'apple' in German (*Apfel*$_{\text{MASC}}$) and Croatian (*jabuka*$_{\text{FEM}}$), then they are *gender-incongruent*. Based on recent research, congruent words are recognized and produced faster than gender incongruent ones (Lemhöfer et al., 2008). The current study will use the term *gender congruency* only when it refers to the gender overlap between languages (i.e., between L1 and L2). The term *gender agreement* will exclusively be reserved for overlap in gender between constituents in one language (i.e., within-language congruency).

Considering that previous studies have given evidence for L1 gender activation, the current study will look at L1 grammatical gender activation during gender agreement in a language that does not grammaticalize gender. Similarly to previous studies, when there is gender overlap, this time in gender between an L1 noun and an anaphoric pronoun in L2, L1 is expected to get activated. Furthermore, the study looks at three L1s that come from different language families; but that also differ in the realization of gender, the number of gender values and the phonological transparency of gender on nouns. The following sections outline the grammatical gender systems for Croatian, Spanish and German, and differences between them in more detail.

2.2.2.1. Gender assignment and agreement in Croatian.

Croatian is a Slavic language and it has three gender values: masculine, feminine and neuter. According to Corbett (1991), feminine nouns are the most common ones (45%), followed by masculine (40%) and then by neuter (15%). Croatian is transparent when it comes to gender assignment. The language has a broad assignment of reliable rules: masculine nouns usually have a consonant at the end, feminine nouns end in a vowel *-a*, and neuter nouns in *-o* or *-e* vowels (Alexander, 2006). This goes to show that gender assignment is not only lexically based, but also phonologically and morphologically transparent.

Table 2. Gender agreement on verbs, adjectives and pronouns in Croatian

	Masculine	Feminine	Neuter
Perfekt	*je vratio*	*je vratila*	*je vratilo*
	be$_{3SG}$ return$_{MASC}$	be$_{3SG}$ return$_{FEM}$	be$_{3SG}$ return$_{NEUT}$
	su vratili	*su vratile*	*su vratila*
	be$_{3PL}$ return$_{MASC}$	be$_{3PL}$ return$_{FEM}$	be$_{3PL}$ return$_{NEUT}$
Pronouns	*on*	*ona*	*ono*
	he$_{3SG.MASC}$	she$_{3SG.FEM}$	it$_{3SG.NEUT}$
	oni$_{MASC}$	*one*	*ona*
	they$_{3PL.MASC}$	they$_{3PL.FEM}$	they$_{3PL.NEUT}$
Adjectives	*crven*	*crvena*	*crveno*
	red$_{3SG.MASC}$	red$_{3SG.FEM}$	red$_{3SG.NEUT}$

Gender agreement is visible on prenominal adjectives and pronouns. There is no gender agreement on articles since Croatian does not have articles. What is more, gender agreement is also expressed on verbs, but only on a compound past tense (*perfekt*). Table 2 illustrates gender agreement in Croatian on verbs, pronouns and adjectives according to gender values.

2.2.2.2. Gender assignment and agreement in Spanish.

Spanish distinguishes between masculine and feminine gender values. Gender assignment follows a consistent set of rules with limited exceptions. Phonological gender assignment rules are very reliable, and 99% of the nouns that end in *-o* are masculine and 96% of the nouns that end in *-a* are feminine (Teschner & Russell, 1984). Regarding phonology, some other noun endings that are reliable indicators of masculine nouns are *-e*, *-m*, *-r*, *-l*; and *-d* for feminine nouns. Some of the typical morphological endings for masculine nouns are *-an*, *-en*, *-az*, and *-drama*; and for feminine nouns *-ción*, *-tiz*, *-ez*, *-cie*, *-umbre*, and *-ima*, among others (Teschner & Russell, 1984).

Gender agreement in Spanish is realized on articles, other determiners, adjectives and pronouns. Articles also mark definiteness, with *el*$_{MASC}$ and *la*$_{FEM}$ articles that are used for definiteness, and *un*$_{MASC}$ and *una*$_{FEM}$ for indefiniteness. Adjective ending for masculine is mostly *-o* (*malo*$_{MASC}$ – 'bad'), and for feminine *-a* (mala$_{FEM}$ – 'bad'), with *-e* ending (*intelligente* - intelligent) sometimes used for either gender. Spanish pronouns are *él* for masculine and *ella* for feminine referents. Table 3 gives an overview of gender agreement in Spanish with some examples.

Table 3. Gender agreement on articles, adjectives and pronouns in Spanish

		Masculine	Feminine
Articles	3rd person singular definite	*el* the$_{\text{MASC.DEF}}$	*la* the$_{\text{FEM.DEF}}$
	3rd person plural definite	*los*$_{\text{MASC.DEF}}$ the$_{\text{MASC.DEF}}$	*las*$_{\text{FEM.DEF}}$ the$_{\text{FEM.DEF}}$
	3rd person singular indefinite	*un* a/an$_{\text{MASC.INDEF}}$	*una* a/an$_{\text{FEM.INDEF}}$
	3rd person plural indefinite	*unos* some$_{\text{MASC.INDEF}}$	*unas* some$_{\text{FEM.INDEF}}$
Adjectives	‘bad’	*malo* bad$_{\text{3SG.MASC}}$	*mala* bad$_{\text{3SG.FEM}}$
Pronouns	3rd person singular	*él* he$_{\text{3SG.MASC}}$	*ella* she$_{\text{3SG.FEM}}$
		élos they$_{\text{3PL.MASC}}$	*ellas* they$_{\text{3PL.FEM}}$

2.2.2.3. Gender assignment and agreement in German.

German has three gender values (masculine, feminine and neuter). Masculine nouns are the most frequent nouns in German (50%), followed by feminine (30%) and then neuter (20%) (Bauch, 1971; as cited in Mills, 1986, p. 32). When it comes to phonological and morphological gender assignment rules, there is a small set of them, and they have many exceptions (Corbett, 1991). Some of the suffixes that are reliably used for masculine nouns are *-ist*, *-ismus*, *-ler*, *-ling*, *-rich*; feminine suffixes can be *-heit*, *-keit*, *-schaft*, *-ung*, *-ei*, and neuter *-chen*, *-lein*, *-ment*, *-nis*, and *-um*, among others (Götze & Hess-Lüttich, 1999). Phonological reliability, on the other hand, is only 60%, even though the rules cover word-initial, word-final, word-internal and general structure topic (Zubin & Köpcke, 1984). This qualifies German as an opaque language in terms of phonological transparency.

Table 4. Gender agreement on articles, adjectives and pronouns in German

		Masculine	Feminine	Neuter
Articles	3rd person singular definite	*der* the$_{\text{MASC.DEF}}$	*die* the$_{\text{FEM.DEF}}$	*das* the$_{\text{NEUT.DEF}}$
	3rd person plural definite	*die* the$_{\text{MASC.DEF}}$	*die* the$_{\text{FEM.DEF}}$	*die* the$_{\text{NEUT.DEF}}$
	3rd person singular indefinite	*ein* a$_{\text{MASC.INDEF}}$	*eine* a$_{\text{FEM.INDEF}}$	*ein* a$_{\text{NEUT.INDEF}}$
Adjectives	'red'	*roter* red$_{\text{3SG.MASC}}$	*rote* red$_{\text{3SG.FEM}}$	*rotes* red$_{\text{3SG.NEUT}}$
Pronouns	3rd person singular	*er* he$_{\text{3SG.MASC}}$	*sie* she$_{\text{3SG.FEM}}$	*es* it$_{\text{3SG.NEUT}}$
		sie he$_{\text{3PL.MASC}}$	*sie* she$_{\text{3PL.FEM}}$	*sie* it$_{\text{3PL.NEUT}}$

In German, gender is realized on articles, other determiners, prenominal adjectives and on pronouns (Table 4). One way of reliably inferring gender assignment is on the basis of the information on determiners and adjectives. However, German gender marking shows syncretism on both determiners and adjectives, as they also have to be marked for number, case and definiteness. Articles marked for definiteness are *der*$_{\text{MASC}}$, *die*$_{\text{FEM}}$ and *das*$_{\textit{NEUT}}$; and for indefiniteness *ein*$_{\text{MASC}}$, *eine*$_{\text{FEM}}$, *ein*$_{\text{NEUT}}$. Yet, gender distinctions are absent on plural determiners, because there is only one gender (*die*) for all three values. Anaphoric pronouns, such as personal pronouns (*er*$_{\text{MASC}}$, *sie*$_{\textit{FEM}}$, *es*$_{\text{NEUT}}$) and prenominal adjectives (*roter*$_{\text{MASC}}$, *rote*$_{\text{FEM}}$, *rotes*$_{\text{NEUT}}$) agree with a given noun and are marked for gender.

2.2.2.4. Summary.

As could be observed, the three languages differ, but also overlap on certain points (Table 5). In terms of language family, they belong to different branches, namely Slavic (Croatian), Romance (Spanish) and Germanic (German). Croatian and German are more complex than Spanish when it comes to the number of gender values, as Spanish lacks the neuter value and makes a distinction only between masculine and feminine. With respect to the rules for the gender assignment system, German is more complex than the two as it has a vast number of small-scope rules that are not always reliable (especially phonological rules), and also the given rules have many exceptions. For this reason, German is labeled as opaque when it comes to phonological transparency, while Croatian and Spanish are more reliable and transparent.

Table 5. Summary of the gender feature in Croatian, Spanish and German

	Croatian	Spanish	German
Language family	Slavic	Romance	Germanic
Gender values	masculine	masculine	masculine
	feminine	feminine	feminine
	neuter		neuter
Phonological transparency	transparent	transparent	opaque
Language selection	early	late	early

Another important difference between the languages relates to gender retrieval. Gender is often described as a gender node linked to the noun (Schriefers & Jescheniak, 1999) or as the information at a lemma level (Carroll, 1989). Based on the *determiner selection interference hypothesis* (Schiller & Caramazza, 2003), the three languages also differ in the competition process for gender selection. For instance, Croatian is described as an early-selection language. This means that phonological context of the noun is not relevant and, therefore, the information does not have to be accessed in order to retrieve the gender (Costa et al., 2003). Because phonological information is irrelevant, it will not slow down the process of the pronoun/determiner selection. Spanish qualifies as a late-selection language. The selection of an appropriate determiner in terms of gender relies on phonological information, which is available only at a later point. Similarly to Croatian, German is classified as an early-selection language when it comes to word production. This means that in order to select the appropriate determiner in Croatian, phonological context does not play a role, and the determiner can be selected as soon as the gender is retrieved.

Therefore, in terms of language selection, Croatian and German are classified as early-selection languages considering that they do not have to rely on phonological context in order to select the appropriate morpheme. On the other hand, Spanish needs to access phonological information before retrieving the correct determiner for use, which means that determiner selection happens at a later stage in word production. Due to different combinations of languages across many aspects; Croatian, Spanish and German lend themselves as a good basis for teasing apart which factors might influence L1 gender co-activation in adult L2 acquisition of English. The following section looks at the research supporting non-selective access of gender, advocating for the gender-integrated representation hypothesis.

2.2.3. Research supporting non-selective access.

Studies on gender processing are still debating how grammatical gender is represented in the bilingual lexicon. Some of the major questions are (i) is the bilinguals' organization of gender in the mental lexicon seen as having shared gender nodes and (ii) how does this function in languages with different gender systems? The following sections explore studies on word production and word recognition in studies that test non-selective access. Moreover, the representation of gender (i.e., *integrated* vs. *autonomous*) will also be explored in more detail regarding different types of languages, but also studies on gender assignment and gender agreement and their results.

2.2.3.1. Word production.

Studies on word production have given mixed results when it comes to monolingual and bilingual speakers. The picture-word interference task was mostly used for monolingual studies, with the expectation that the gender interference effect will be observed when the pictures are presented along with the distractor word that does not overlap in gender (Figure 11). Participants were asked to name a picture by using a bare noun a noun phrase (i.e., determiner-noun phrase, determiner-adjective-noun phrase or adjective-noun phrase).

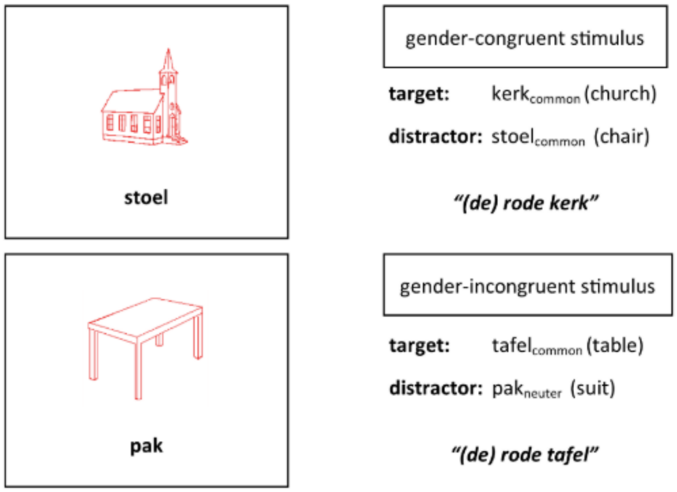

Figure 11. The stimuli used in the picture-word interference task by Schriefers (1993) adapted from Klassen (2016a, p. 53)

Studies on bare noun production found no effects in Dutch (La Heij, Mak, Sander, & Willeboordse, 1998; Starreveld & La Heij, 2004), but shorter naming latencies were present in studies on Spanish and Italian (Cubelli, Lotto, Paolieri, Girelli, & Job, 2005; Paolieri, Cubelli, et al., 2010). The opposite picture was found with full noun phrase (NP) production with Germanic languages such as German (Schiller & Caramazza, 2003; Schriefers & Teruel, 2000) and Dutch (La Heij et al., 1998; Schiller & Caramazza, 2003; Schriefers, 1993; Starreveld & La Heij, 2004) showing gender interference and Romance languages (i.e., French, Catalan, Spanish and Italian) not showing the interference (Alario & Caramazza, 2002; Costa, Sebastián-Gallés, Miozzo, & Caramazza, 1999; Cubelli et al., 2005; Miozzo & Caramazza, 1999). The studies used determiners (D), adjectives (A) and nouns (N) in different combinations in noun phrases (e.g., D+N, D+A+N, A+N). The evidence so far does not support the WEAVER++ model's statement that the gender will be retrieved only in contexts where it is necessary, as we see congruency effects even in bare nouns in Romance languages (Alario, Ayora, Costa, & Melinger, 2008). On the other hand, the *determiner selection interference hypothesis* (Miozzo & Caramazza, 1999) states that determiner selection, rather than gender nodes, compete for selection.

Slightly different results could be observed with adult L2 learners during L2 picture naming task where a picture would either have the same gender in L1 and L2, or not. This time, a gender congruency effect is expected when the two genders overlap, i.e. response times should be faster for congruent than for incongruent pairs. Similarly to monolingual studies, no effect was observed for NPs in Romance languages (i.e., French, Spanish, Catalan and Italian) and in Croatian (Costa et al., 2003). However, other studies have shown gender congruency in both bare nouns and NPs for Italian-Spanish (Morales et al., 2011; Paolieri et al., 2010; Paolieri et al., 2018), Greek-German (Salamoura & Williams, 2007), German-Dutch (Lemhöfer et al., 2008) , German-Czech (Bordag & Pechmann, 2007) and Russian-Spanish (Paolieri et al., 2018) combinations. In the following, major studies supporting the *gender-integrating representation* hypothesis will be outlined.

Aside from the picture naming tasks, translation tasks were also widely used for testing word production models, however, the process of naming in L1 and L2 might not follow the same path as the process of translation. In a translation task, bilinguals are asked to translate nouns written in their L1 by using either a bare noun or a noun phrase consisting of an article and/or adjective. During the translation process, participants may focus only on the translation language and will reduce the activation of the given language (Bordag & Pechmann, 2007). Moreover, even though both languages have to be activated, they do not necessarily have to be activated simultaneously, but the translation process could go through different stages. Salamoura and Williams (2007) wanted to test the *gender-autonomous hypothesis* by using a Greek and German language combination and by using a novel task. Therefore, they tested L1 Greek L2 German speakers in a translation task from their L1 to the L2, where they would translate cognates and noncognates in either bare nouns or adjective+noun NP contexts. Both Greek and German have a three-way gender system (i.e., masculine, feminine and neuter), they are from different language families, and speakers of them both show congruency effect in monolingual studies (Plemmenou, Bard, & Branigan, 2002; Schiller & Caramazza, 2003; Schriefers & Teruel, 2000). The German gender system is opaque, while the Greek gender system is transparent. The results showed that when it came to bare nouns, no congruency effect was found, but the gender congruency effect appeared in NPs for both cognates and noncognates, even though cognates were translated only slightly faster. Also, the error rates were higher with gender incongruent nouns, similar to the study by Lemhöfer et al. (2008) which will be discussed in one of the following paragraphs. The study by Salamoura and Williams (2007) explained the lack of gender congruency effect in bare nouns as gender being unnecessary information which does not have to be selected, as the context is not a gender agreement context.

Regarding Slavic languages, Bordag and Pechmann (2007) conducted a study where they tested upper intermediate to advanced L1 Czech L2 German language users in a picture naming task. The tasks ranged from a monolingual (i.e., in L2 German or L2) to a bilingual mode (i.e., code-switching between L1 and L2), in order to see in which direction the gender congruency effect would take place. In some experiments, participants were required to name the picture only using bare nouns and in others noun should have been named with an adjective 'big' (*groß*) or 'small' (*klein*). What the results showed is that gender congruency was present in L2 German mode and in a bilingual mode on both bare nouns and NPs.

Lemhöfer et al. (2008) also looked at gender congruency effects, this time with L1 German L2 Dutch speakers by using a primed lexical decision task (LDT) and a picture naming task (PNT). The experiments aimed at investigating what happens in comprehension and production tasks when two languages differ in the number of gender values (binary vs. tripartite gender languages), and also if word form overlap (cognates vs. noncognates) has an effect on gender activation. In the LDT the target words were primed with definite articles in the target language (i.e., Dutch), that actually show the difference in gender, and with indefinite articles that make no gender distinction. Dutch has a two-gender distinction (i.e., common and neuter) and German has a three-gender distinction (i.e., masculine, feminine and neuter). Words were either congruent or incongruent in gender with L1 German translations (i.e., common gender in Dutch was congruent with feminine or masculine gender in German, and Dutch neuter gender with German neuter gender), and they either overlapped in meaning and form (cognates) or only in meaning (noncognates). In the PNT, the same words from the LDT were used, only in a form of pictures, and this time they had to be named either by only using bare nouns or with a definite determiner. Experiment 3 was the same as the PNT, only with an addition of training before the main experiment which involved naming pictures with the determiner. If the participants made a mistake they would get corrected. The training was repeated three timed in order to ensure that L1 German learners of Dutch, despite the slightly lower Dutch proficiency than participants in other experiments, were familiarized with the items and their gender. In all three experiments it could be observed that gender-congruent nouns were either produced or processed faster, but the effects were stronger for cognates.

Paolieri et al. (2010) found congruency effect for bare noun (e.g., *casa*$_{\text{FEM}}$) and determiner-noun (e.g., *la*$_{\text{FEM}}$ *casa*$_{\text{FEM}}$) in naming and translating tasks in L2 Italian. The study with Spanish-Italian bilinguals found shorter naming latencies for L1 Spanish and L2 Italian words that overlapped in gender (i.e., gender congruent), than for words that do not overlap in gender (i.e., gender incongruent). No effect was found for Spanish monolingual speakers.

Morales et al. (2011) tested L1 Italian L2 Spanish speakers in bare noun naming where the gender congruency effect was also visible in faster naming times for gender-congruent nouns than for gender-incongruent nouns. In the second experiment, the participants were presented with the same pictures as in Experiment 1, but this time around they had to name only L1 articles of the object on the picture. Some of the pictures were presented only once, and some of them even up to five times. The gender congruency effect was more visible for those items that were presented several times than for nouns that were seen only once. Novel items produced no gender congruency effect, which suggests that there is active inhibition of L1 gender information during picture naming.

When it comes to languages with asymmetric gender systems, a study by Klassen (2016) tested L1 gender activation in intermediate L1 Spanish L2 German learners by using a L2 picture naming task. Words in L1 and L2 were either gender-congruent (e.g., masculine-masculine), gender-incongruent (e.g., masculine-feminine) or gender-incongruent in a combination with a neuter value (e.g., masculine-neuter). Participants were asked to name a picture by using either bare nouns or noun phrases which comprised of determiner and noun constituents. The gender congruency effect was present in terms of shorter naming latencies, while nouns that were paired with neuter gender were also named significantly more quickly compared to gender-incongruent nouns. Klassen (2016b) argues that the neuter node is stored separately from masculine and feminine nodes, if there is only one language that has the neuter gender value. Because the neuter gender node cannot be shared with L1 Spanish, as it lack the gender value, neuter will not be activated automatically. Klassen (2016) also termed this theory as the *asymmetric gender representation hypothesis*.

In a picture-naming study by Manolescu and Jarema (2015), highly proficient Romanian-French bilinguals that started learning French early in childhood and French monolinguals were tested. The two languages used in the study have asymmetric gender systems, i.e., Romanian has three genders (masculine, feminine and neuter) and French has two genders (masculine and feminine). The study used a picture naming task in L2 French and a translation task form L1 Romanian to L2 French. Regardless of the asymmetric nature of the gender systems, the gender congruency effect was still obtained in bare noun and NP (indefinite D+N) production tasks. The neuter value was used in the neuter incongruent condition (neuter-masculine and neuter-feminine), and the results revealed significant differences in RTs between gender-congruent, but no differences when compared to gender-incongruent nouns with the neuter-incongruent condition.

Another study on languages with two experiments on same and different gender values was a study by Paolieri (2018) with Italian and Russian learners of Spanish. Thirty-two advanced Italian L2 Spanish learners were tested in Experiment 1. The study focused on the similarity of the gender system and the role of concreteness during grammatical gender retrieval. The rationale for using concreteness as a variable in the study is the assumption that concrete words are stored with more semantic features in the bilingual lexicon than the abstract words, which leads to more shared semantic features between the L1 word and the L2 translation (De Groot, 1989; Paolieri et al., 2018). In the task, participants were supposed to translate written L1 Italian words into L2 Spanish by using either a bare noun or a noun phrase (D+N). The gender congruency effect was visible along with the concreteness effect (i.e., concrete nouns were translated faster than abstract nouns). Also, the incongruent-neuter condition (e.g., neuter-feminine) was translated faster than the incongruent condition (e.g., masculine-feminine) in the bare noun task. The results support Klassen's (2016) claim that neuter nouns behave differently from the masculine and feminine words. The second experiment was the same as Experiment 1, this time with 54 L1 Russian L2 Spanish learners. The results revealed the gender congruency effect in concrete nouns in both bare noun and NPs. However, gender congruency was only significant with noun phrases for abstract words. The authors (Paolieri et al., 2018) conclude that semantic (concreteness) and grammatical (gender) information are closely related in the bilingual lexicon, at least when it comes to spoken word production.

The study by Costa et al. (2003) was the only study on word production which showed no gender congruency effect (see Section 2.2.4. for more detail). Costa et al. (2003) found the cognate facilitation effect bilingual (e.g., Spanish-Catalan) and monolingual (e.g., Spanish) groups, but on the other hand, found no effect with Croatian learners of Italian. Other studies found gender congruency effects in Romance (Paolieri et al., 2010), Germanic (Lemhöfer et al., 2008; Salamoura & Williams, 2007) and Slavic languages (Bordag & Pechmann, 2007). One of the reasons why there was no gender congruency effect on noun phrases when it came to languages like Spanish and Italian might be due to the fact that these effects were also not observed in monolingual studies (Alario & Caramazza, 2002; Costa, Alario, & Caramazza, 2005; Costa, Sebastián-Gallés, et al., 1999; Cubelli, Paolieri, Lotto, & Job, 2011; Miozzo & Caramazza, 1999; Miozzo, Costa, & Caramazza, 2002). Therefore, the research on gender activation during word production mostly supports the *gender-integrated representational hypothesis*, with some evidence supporting a newly developed *asymmetric gender representation hypothesis.* The following section outlines studies on gender activation during word recognition in bilingual research.

2.2.3.2. Word recognition.

Aside from Lemhöfer et al.'s (2008) study on written word recognition which found gender congruency effects, Weber and Paris (2004) also investigated word recognition. However, this time it was spoken word recognition. The visual world paradigm was used where participants looked at visual scenes during eye-tracking. The study investigated two languages with different gender systems, namely, French (two values) and German (three values). Participants were proficient adult L1 French L2 German learners. After receiving auditory instructions during eye tracking (*Wo befindet sich die Kassette*$_{\text{FEM}}$? – 'Where is the tape$_{\text{FEM}}$?'), the participants were required to click on the target object out of four pictures on the screen. The two out of four objects were fillers, the third word was the target word (*Kassette*$_{\text{GER}}$) which was gender-congruent in L1 French (*cassette*$_{\text{FEM}}$), and the competitor which overlapped in the phonology of the word onset in both L1 and L2 (*Kanone* – 'cannon'). The competitor always shared the gender with the target in L2 German. However, the gender of target and competitor L1 French translations overlapped in gender (*perle*$_{\text{FEM}}$ and *perruque*$_{\text{MASC}}$) or they did not overlap (*cassette*$_{\text{FEM}}$ and *canon*$_{\text{MASC}}$). When L1 French and L2 German target and competitor words overlapped in gender in both languages, participants fixated the competitor objects more than the filler objects. Yet, when the target and competitor items only overlapped in gender in L2 German, the participants did not have the tendency to fixate the competitor. However, phonological information (overlap between L1 and L2) was not controlled for, which might have had an effect during the experiment as evidenced in L2 transfer (Spivey & Marian, 1999). Also, the cognate status might have had an effect, as the lexical and meaning overlap heighten the co-activation of the L2 (Lemhöfer et al., 2008).

Morales et al. (2016) replicated the study by Weber and Paris (2004) and tested advanced L1 Italian learners of L2 Spanish. Monolingual Spanish speakers were also tested. This time around, only a pair of pictures was presented with an accompanying auditory instruction (*Encuentra la*$_{\text{FEM}}$ *bufanda*$_{\text{FEM}}$. – 'Find the$_{\text{FEM}}$ scarf$_{\text{FEM}}$'). Similarly to Weber and Paris (2004), the words overlapped in gender in L2 Spanish, but were gender-congruent or gender-incongruent with L1 Italian. The participants fixated the competitor less quickly when the gender of its L1 translation did not overlap with the L2 gender. In the second experiment, only noncognate words were used and a third condition was added where the gender of the target and competitor noun was incongruent in both L1 Italian and L2 Spanish. Because the participants fixated the target noun 360 ms after the onset of the determiner in the incongruent condition (i.e., 200 ms are necessary for the launching of eye-movements), the authors (Morales et al., 2016) concluded that shortly after the L2 gender activation, the L1 gender information becomes co-activated. Monolinguals showed no gender congruency effects.

All three studies on spoken or written word recognition show the activation of L1 grammatical gender during L2 processing. The study by Lemhöfer et al. (2008) looked at bare nouns and determiner-noun phrases, and Weber and Paris (2004) and Morales et al. (2016) looked at the agreement between a determiner and a noun in a sentence context with different language combinations (German-Dutch, French-German and Italian-Spanish). However, before looking at the L1 gender co-activation during gender agreement, the evidence for non-selectivity from studies on gender activation at a word level during bare noun recognition will be presented, along with its challenges regarding the integrated nature of the mental lexicon. The following section looks at studies that found evidence against non-selectivity of L1 and L2.

2.2.4. Evidence against non-selective access.

The area of word production found mixed-results in studies on both monolingual and bilingual lexical access regarding the activation of grammatical gender. When it comees to gender interference in monolinguals, many studies found gender interference effect for Romance languages (Italian and Spanish) in a picture-word interference task, but only in bare nouns (Cubelli et al., 2005, 2011; Paolieri et al., 2010). However, no effect was found for Germanic languages (Dutch) when it came to bare noun production (La Heij et al., 1998), but the effect was present in NP production (Schiller & Caramazza, 2003; Schriefers, 1993; Schriefers & Teruel, 2000; Van Berkum, 1997).

A picture-naming study by Costa et al. (2003) was one of the first studies which investigated the activation of gender in the bilingual lexicon in production. In a series of experiments, Croatian-Italian, Spanish-Catalan, Catalan-Spanish and Italian-French highly-proficient L2 learners were tested and compared to monolinguals of the respective languages. Half of the pictures had the same gender as the translation equivalent in their L2 (i.e., gender-congruent), and the other half were gender-incongruent. If gender-congruent nouns were named faster, then this would support the gender-integrated view on the lexicon. However, if there was no difference in response times between gender-congruent and incongruent nouns, then this would support language autonomy.

The participants in Costa et al.'s (2003) study were: 24 L1 Spanish L2 Catalan learners, 24 L1 Catalan L2 Spanish learners, 10 L1 Italian L2 French learners and 10 L1 Croatian L2 Italian learners. The first experiment was conducted with Spanish learners of L2 Catalan and Catalan learners of L2 English. The results showed faster RTs for the congruent condition as opposed to the incongruent condition. However, the same result was observed with a monolingual Spanish group, so the gender congruency effect was not taken as a valid argument for results in the L2 learner group, which means that the reason for the effect might be something other than L1 and L2 gender congruency. The same experiment, this time with Italian and French gender congruent and incongruent nouns, was conducted with proficient L1 Italian L2 French learners. Similarly, the gender congruency effect was found with the monolingual and L2 learner groups, so the effect was discarded as a plausible explanation. In the study with 10 L1 Croatian L2 Italian learners, three tasks were distributed. The first experiment was the same picture naming task as with other groups, this time naming should be done by using a DP (i.e., determiner+noun). Even though neuter nouns were excluded due to the fact that the neuter value does not exist in Italian, no gender congruency effect was observed. In order to see if long naming latencies had an effect on the results, a speeded naming task was performed which also revealed no congruency effects. In the last task, participants had to name pictures in both L1 and L2 and were required to use an adjective ‘my’ in Croatian (*moj*$_{\text{MASC}}$/*moja*$_{\text{FEM}}$) and Italian (*mio*$_{\text{MASC}}$/*mia*$_{\text{FEM}}$) followed by a noun in the target language, because Croatian language does not use articles where the gender could be visible. Once again, no effect of gender congruency was found. To conclude, even though some of the experiments in Costa el al. (2003) revealed differences between gender-congruent and gender-incongruent nouns, the gender congruency effect was also visible with monolinguals and for that reason is discarded as a possible explanation for the results. The tasks with Croatian learners of L2 Italian revealed no statistical difference between the gender congruency and incongruent condition.

2.2.5. Syntactic gender agreement in bilinguals.

Gender can be divided into lexical and syntactic gender. When we talk about lexical gender that is represented as a gender node at a lemma level, we talk about gender assignment (Carroll, 1989; Schriefers & Jescheniak, 1999). Syntactically, gender is realized through gender agreement between a noun and other constituents within a phrase (e.g., determiners and adjectives) or a clause (e.g., pronouns). Within formal models, gender agreement can also be defined as feature checking between a noun and other dependents in a clause (Carstens, 2000).

When it comes to online processing, adult L2 learners have shown to have difficulties in using gender cues predictively, as was the case with a study by Guillelmon and Grosjean (2001). The study was conducted with monolingual French speakers, and early and late English-French L2 learners in order to test if the learners were sensitive to gender agreement errors. The participants listened to the recording of a determiner-adjective-noun (*la*$_{\text{FEM}}$ *jolie*$_{\text{FEM}}$ *glace*$_{\text{FEM}}$ – ‘the nice mirror’, **le*$_{\text{MASC}}$ *joli*$_{\text{MASC}}$ *glace*$_{\text{FEM}}$) and were asked to repeat the phrase as quickly as possible. Only early L2 learners and monolinguals showed sensitivity to gender information by repeating within-language gender-congruent (gender matched) NPs faster than gender-incongruent (mismatched) NPs. This means that early L2 learners activated L2 French gender information during online processing, even though their L1 English lacks the feature. However, no such effect was found with adult L2 French learners. The lack of gender effect was explained in terms of fundamental differences between L1 and L2 speakers which make it harder for late L2 learners to completely acquire gender.

ERP (event-related potential) studies looking at the local agreement between a determiner and a noun have shown a native-like performance for advanced L2 speakers and a sensitivity to gender mismatch for L2 beginners (Foucart & Frenck-Mestre, 2011; Tokowicz & MacWhinney, 2005). This was especially the case when the word in the languages had the same gender. Yet, when it came to nouns with different genders across the two languages, not all L2 learners were sensitive to gender agreement violations. L2 learners whose L1 realizes grammatical gender differently tend to show delayed effects (Sabourin & Stowe, 2008). In a study by Sabourin and Stowe (2008) only German learners of Dutch and monolingual Dutch speakers displayed sensitivity grammatical gender violations. Romance learners of Dutch, however, did not display P600 response to syntactic violations in the case of grammatical gender, which further advocates for grammatical L1 and L2 differences affecting the L1 gender activation.

Keating (2009) conducted an eye tracking study with Spanish monolinguals and English learners of L2 Spanish on different types of gender agreement dependencies, i.e. between a noun and an adjective in a determiner phrase (*una*$_{\text{FEM}}$ *casa*$_{\text{FEM}}$ *pequeña*$_{\text{FEM}}$ – ‘ a$_{\text{FEM}}$ small$_{\text{FEM}}$ house$_{\text{FEMFEM}}$’), verb phrase (*la*$_{\text{FEM}}$ *casa*$_{\text{FEM}}$ *es bastante pequeña*$_{\text{FEM}}$ – ‘a house$_{\text{FEM}}$ is quite small$_{\text{FEM}}$’) and a new complement phrase (*una*$_{\text{FEM}}$ *casa*$_{\text{FEM}}$ *cuesta menos si es pequeña*$_{\text{FEM}}$ – ‘a$_{\text{FEM}}$ house$_{\text{FEM}}$ costs less if it is small$_{\text{FEM}}$’). L2 learners differed in L2 Spanish proficiency and were grouped accordingly: beginning, intermediate and advanced. Advanced learners had no issues with detecting gender agreement violations in determiner phrases, but showed no sensitivity when encountered with nonlocal agreement in verb phrases or a verb clause. Beginner and intermediate learners showed real-time L2 processing that is not similar to native Spanish speakers. An ERP study by Foucart and Frenck-Mestre (2012) also showed similar results, where L1 English learners of L2 French seemed to have trouble with non-local gender dependencies and elicited no P600.

All the studies above examined features that are either present in both languages, or present only in L2. However, Ganushchak, Verdonschot, and Schiller (2011) looked at L1 grammatical gender co-activation of Dutch into an L2 that lacks gender - English. The study was conducted with 20 proficient L1 Dutch learners of L2 English who were asked to perform a word color classification task during an ERP task. The participants were asked to group words in white according to their grammatical gender in Dutch and colored words according to their color. The colored words were Dutch words, which had either a common or neuter gender, and their English translations. Participants made decisions by clicking the left key for the Dutch common gender and the right key for the Dutch neuter gender when white words were presented. As for the colored words (green and blue), the key assignment was balanced across subjects. Congruent trials were the ones where the gender value and the color used the same key for decision, and incongruent trials were the ones where the keys for color and gender decision differed. The differences in RTs for two conditions did not show any significant difference, however, the results showed that error rates were higher with incongruent trials (response conflict) than in the congruent condition. ERPs also revealed greater event-related negativity (ERN), usually found where there is response conflict and sensitivity to violations, which further confirms that grammatical features such as gender can also be activated in isolation in the L2 even if the same feature is absent in an L2.

A study by Scheutz and Eberhard (2004) investigated if L1 German grammatical gender gets activated during L2 English processing. Twenty English monolinguals and 20 proficient German learners of English were tested in a reading study. The sentences introduced nouns in English which end in *–er* agentive morpheme. Even though in English the morpheme *–er* does not signal the gender of the agent, in German the ending is associates with the masculine gender (e.g., *Lehrer* 'teacher$_{\mathrm{MASC}}$', *Fahrer* 'driver$_{\mathrm{MASC}}$'). In the continuation of the sentence, a masculine or a feminine reflexive pronoun gets introduced that refers to the antecedent noun with the ending *–er* (*The robber disguised himself/herself by wearing a mask*) (Scheutz & Eberhard, 2004, p. 566). The authors wanted to investigate if the noun in English will be associated more with the masculine reflexive pronoun, which would show interference effects when the reflexive pronoun has feminine gender. Scheutz and Eberhard (2004) found that L1 German learners had a male bias when processing L2 English nouns that ended in *-er* suffix in eye-tracking during reading which is seen in the difference between total fixations on pronouns *herself* and *himself*. The English control group did not show the same effect when processing male bias nouns. The study implies transfer of an L1 feature in a L2 where the feature is non-existent and irrelevant.

A study by Cook (2018) investigated L1 grammatical gender effects in L2 processing of animate and inanimate nouns in a self-paced reading task. The aim of the study was to test the *sex and gender hypothesis* (SAGH) (Vigliocco, Vinson, Paganelli, & Dworzynski, 2005) which postulates, that even when it comes to processing of the referent's sex, still, grammatical (formal) gender can be 'incorrectly' activated. This phenomenon happens because it is difficult to tease apart formal gender features from sex features as they are closely associated. The weak version of SAGH states that languages which have a more similar value-distinction of grammatical gender (like Romance languages: masculine vs. feminine) would generalize the biological gender (male vs. female) to other sexual entities, such as animals. The strong version of SAGH states that the role of noun animacy is not an important factor and that L1 gender transfer will happen with both animate and non-animate nouns. Cook (2018) tested 24 advanced Russian L2 English learners on L1 Russian gender co-activation during online gender agreement processing. The self-paced study used sentences introducing an animate noun (e.g., 'turtle' - *черепаха*$_{\text{FEM}}$) or an inanimate noun (e.g., 'newspaper' - *газета*$_{\text{FEM}}$) which had masculine or feminine gender in Russian. In the continuation, an anaphoric pronoun gets introduced referring back to the noun. The pronouns either matched with the noun, mismatched or were neutral (i.e., pronoun *it* was used) (1) (Cook, 2018, p. 8).

(1) a. The turtle$_{\text{FEM}}$ crawled under the rock where *it/she/he* felt safe again.
    b. The newspaper$_{\text{FEM}}$ sat on the counter when *it/she/he* caught my attention.

The results show slower reading times for the pronoun segment in the incongruent condition for animate nouns (1a). The gender congruency effect, however, was not present for inanimate nouns (1b). Therefore, the study supports the weak version of SAGH whereby the interference is mediated by other factors, such as semantic information (animacy). Overall, the study shows that L1 grammatical gender can be transferred in a non-gendered L2, but apparently with certain restrictions.

In an eye-tracking study by Conklin et al. (2007), L1 Dutch learners of English listened to English sentences while observing a visual scene with a character and an object (Figure 12).

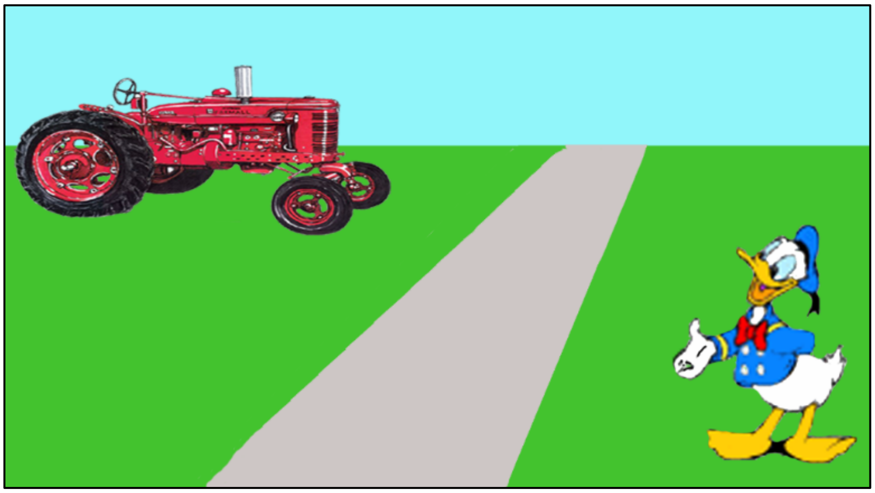

Figure 12. Eye tracking study by Conklin et al. (2007) on L1 Dutch grammatical gender co-activation in L2 English during gender agreement

Two groups were tested, namely, 14 Dutch learners of English and 14 English native speakers. Three sentences in English were introduced for each picture. In the first sentence, the animate character (*Donald Duck*) and the inanimate object (*tractor*) were introduced. The second sentence always began with an anaphoric pronoun (*he/she*) that referred to the character from the previous sentence. Furthermore, the third sentence talked about the intention of the character with the object (2).

(2) The tractor will be driven by Donald Duck.
He is in the other field.
Donald needs to cross the road to get to the tractor.

The results of monolingual English speakers of interest were the proportion of fixations to the inanimate noun when the participants hear the pronoun *he*. In this case the animate character (*Donald Duck*) was always fixated at the onset of the pronoun as the gendered pronoun can only refer to the character in English. However, Dutch learners of English have an additional gender system from their L1 which can affect the interpretation of anaphora resolution, as the noun *tractor* has masculine gender in Dutch (3).

(3) De tractor$_{\text{MASC}}$ zal bestuurd worden door Donald Duck.
The tractor will be driven by Donald Duck.
Hij$_{\text{MASC}}$ staat in het andere veld.

He is in the other field.

Donald needs to cross the road to get to the tractor.

The authors were interested if L1 Dutch gender would get activated and if this effect would be modulated by word form overlap (cognates vs. noncognates). According to the BIA+ model (Dijkstra & Van Heuven, 2002) cognates receive additional activation because they have shared features (form and meaning) in the bilingual mental lexicon. Based on previous studies (Costa et al., 1999; Schwartz & Kroll, 2006), the chances of finding a L1 gender transfer effect are more likely with cognates than noncognates. For Dutch learners of English, aside from the gender of the character, the first sentence also activates the gender of the inanimate object in Dutch (*tractor*$_{\text{MASC}}$). Therefore, when encountering the anaphoric pronoun *he,* the participants may compute the gender agreement with the character (Donald Duck) or the object (tractor). The experimental item in (3) is an example of gender congruency (i.e., gender overlap with the inanimate object and a pronoun) in the case of cognates (i.e., *tractor*). The gender-incongruent item would be with the female character Daisy Duck and a pronoun *she*, so that the feminine pronoun can never refer to the object *tractor* which has a masculine gender. Sentences with noncognates followed the same construction, but only used words that overlap in meaning and not in form (*kite* – *vlieger*$_{\text{MASC}}$ in Dutch). Therefore, Conklin et al. (2007) manipulated gender congruency between the object and the pronoun and the overlap of L1 and L2 word forms (cognates vs. noncognates).

For the L1 Dutch group, the results from the eye tracking study showed increased looks to the inanimate object (*tractor*$_{\text{MASC}}$) from 600-1400 ms after the pronoun onset when the pronoun overlapped in gender (e.g., *he*$_{\text{MASC}}$), as opposed to when the noun and the pronoun did not share the same gender (*tractor*$_{\text{MASC}}$ + *she*$_{\text{FEM}}$). However, this gender congruency effect only occurred with words that overlapped in form and meaning (i.e., cognates). This means that when a noncognate was presented in the first sentence (*kite* - *vlieger*$_{\text{MASC}}$), no increased looks were recorded after the onset of the gender-congruent pronoun. Considering that the results showed no effect in monolingual English speakers, but showed L1 gender effects during gender agreement in L2, limited by the words that overlap in form and meaning, the study further confirms the activation of L1 Dutch gender information during online anaphora processing in English. Moreover, the effect was modulated by word type which further supports the BIA+ model of non-selective lexical access stating that cognates activate representation across both languages.

In an ERP study by Renner (2014), low-proficiency L1 German learners of English were tested on L1 grammatical gender activation in their L2 when it came to anaphoric pronoun resolution in processing. Similarly to Conklin et al. (2007), the study looked at L1 grammatical gender activation, but used a different L1 (i.e., German) and a different online sentence comprehension method (i.e., ERP). Each stimulus consisted of pairs of sentences, whereby the first sentence would introduce an inanimate object and the second one would start with a pronoun that could either be gender-congruent or gender-incongruent with the noun (4) (Renner, 2014, p. 145).

(4) This is a bus.
*He/*she/it is big and crowded.

In this study, inanimate nouns were not controlled for cognate status, and they had three conditions: (i) the correct condition (an inanimate noun combined with the inanimate pronoun, which would be a correct pronoun in English), (ii) the pseudocongruent condition (the gender of the noun overlaps with the pronoun in German) and (iii) the incongruent condition (the gender of the noun neither overlaps with the pronoun in German nor in English). The study predicted that the L1 German group would show the activation of L1 German gender of the inanimate noun (i.e., *bus* – 'der Bus_{MASC}') when it overlaps in gender with the pronoun in English (i.e., *he*). Offline measures showed the activation of L1 gender in a grammaticality judgment task, i.e. participants showed higher errors rates when the pronoun used could be used to refer to the inanimate object in German (pseudocongruent condition) than in the correct or incongruent condition. However, online data did not support the results of the error rates by showing P600 differences only between the correct and the two other conditions (incongruent and pseudocongruent). According to Renner (2014), the pseudocongruent condition was expected to lie somewhere between the correct and incongruent one. Although the pseudocongruent option is incorrect in English, if the L1 was activated, it would still be a grammatical choice. When the study split the participants based on proficiency, the low proficiency level group showed signs of L1 co-activation during online processing, and with the high proficiency group the transfer was not visible. The study concludes that L1 transfer is present, but can be decreased in L2 processing, as it could be seen in the results of ERPs.

Studies show that an L1 feature can be transferred into an L2 which lacks the feature, which is in this case grammatical gender (Barto-Sisamout, Nicol, Witzel, & Witzel, 2009; Conklin et al., 2007; Cook, 2018; Ganushchak et al., 2011; Renner, 2014; Scheutz & Eberhard, 2004; Vigliocco et al., 2005). Studies on gender have given evidence for L1 gender activation, but have also pointed out certain limitations, such as L2 proficiency (Barto-Sisamout et al., 2009), animacy (Cook, 2018) and word form overlap (Conklin et al., 2007). This means that even though L1 information is not relevant in the L2 context, it still gets activated. These findings are compatible with the notion of language non-selective access (Dijkstra & Van Heuven, 2002). The current study will try to address further questions that have not been addressed in L1 gender activation during gender agreement processing. Firstly, the study at hand will focus on three languages from different language families (i.e., German, Croatian and Spanish) and with different gender assignment systems (simple and complex). The study will also look at possible effect of phonological transparency (transparent and opaque) and gender classification (two-way and three-way). Moreover, a visual world paradigm (i.e., tracking eye movements while listening to a spoken discourse and observing a visual scene) will be used as an online method to test if L1 grammatical gender gets activated in a context when the information is irrelevant. Additionally, word type (cognate vs. noncognate) will be introduced as an additional factor in order to test if the combination of lexical and gender overlap has an effect on L1 co-activation. Therefore, the study is two-fold. It investigates (i) under which conditions L1 grammatical gender gets activated and (ii) if crosslinguistic differences of the L1 and the L2 language influence the amount of L1 gender effects. Section 2.3. discusses Experiment 1 of the current study.

2.3. Experiment 1: L1 Grammatical Gender Co-Activation in a L2 English Context

2.3.1. Overview and research questions.

The current study focuses on the activation of L1 grammatical gender in a non-gendered L2. The topics of investigation concern the activation of L1 morphosyntactic information of a gendered language during L2 processing in a context where grammatical gender information is irrelevant. The study is a conceptual replication of Conklin et al. (2007) with adult L1

German L2 English learners. A novel aspect introduced here is a new L1 that also differs in regard to the number of grammatical gender values (Dutch has two genders, German has three genders). The study uses the visual world paradigm as an online method for investigating the L1 grammatical gender co-activation during gender agreement in L2 English, but also looks at how lexical overlap influences the co-activation of L1 gender.

Accordingly, the following research questions are posed and the corresponding hypotheses are proposed:

Research question 1: Do adult L2 English learners co-activate L1 grammatical gender in an L2 that lacks grammatical gender?

Hypothesis 1: L1 grammatical gender will get activated in the L2 that lacks grammatical gender.

Research question 2: Does word form overlap influence the activation of L1 grammatical gender?

Hypothesis 2: The activation of L1 grammatical gender will only happen with cognates.

The first question addressed deals with the activation of gender specifically during L2 gender agreement processing. Previous research has shown abundant evidence when it came to L1 gender co-activation at a word level in L2 production and comprehension (Ganushchak et al., 2011; Lemhöfer et al., 2008; Morales et al., 2011; Paolieri et al., 2010). When it came to studies on gender agreement, various factors seemed to modulate crosslinguistic influence. For instance, Cook (2018) found animacy to be an important variable in a self-paced reading study, as the author only found L1 gender c-activation with animate nouns (i.e., animals). Renner (2014) obtained an effect in error rates in an offline grammaticality judgment task, but no effect in ERP measures. On the other hand, Conklin et al. (2007) found that L1 grammatical gender is only visible when there is meaning and form overlap (i.e., cognates), but if the meaning is only shared at the word level, L1 gender will not be activated. Aside from animacy and lexical overlap, the type of measure also seems to have an impact on L1 transfer visibility.

Because there is some evidence of L1 grammatical gender co-activation in the previous studies on gender assignment and agreement, the current study hypothesizes that L1 grammatical gender of German will get activated during L2 pronoun processing. Also, similarly to Conklin (2007), it hypothesizes that the L1 gender co-activation will be more visible when there is gender and lexical overlap (with cognates), than when only meaning overlap is present (with noncognates). The following section describes participants tested in this study in more detail.

2.3.2. Participants.

Experiment 1 tested 24 L1 German L2 English learners (19 female) with a mean age of 24.13 years (*SD* = 3.42, range: 21-33). The participants were recruited in Braunschweig, Germany, and they were all students of English at a German university. An online language background questionnaire was administered during the experiment, where they enter information about their skills and proficiency in English language, and also if they have knowledge of other languages (Table 6). They started learning English approximately at the age of 8, and they had been learning it for 14 years mostly in a classroom setting. None of the students were bilinguals, although some of them had general knowledge in an additional language (e.g., French, Spanish and Low German).

Table 6. Experiment 1. L2 participant information (*n* = 24)

	Mean	Range	Standard deviation
Age (in years)	24.13	21–33	3.42
Age of onset (in years)	8.38	3–13	1.90
Years of learning L2	14.67	11–23	3.02
English LexTALE (score/max 100)	81.88	47.5–97.5	12.09
German LexTALE (score/max 100)	91.41	62.5–100	7.99
English CFT (words/minute)	36.71	27–44	4.78
German CFT (words/minute)	42.54	29–54	7.70

The students were tested on their proficiency of English and German with two tests: LexTALE and a category fluency task (CFT). LexTALE is an English proficiency test that was validated through correlations with TOEIC (*Test of English for International Communication*) and the Quick Oxford Placement Test (Lemhöfer & Broersma, 2012). It uses 60 items, 40 of the items are real English words of different word frequency and 20 of them are non-words. The same test was developed for Dutch and German based on the same principles, just with German words and words frequencies, which was used in this study as well. L1 German learners of English showed an advanced proficiency in the English version of LexTALE (M = 82.92, SD = 11.18) and performed better in the German LexTALE (M = 93.49, SD = 5.72), based on the maximum possible score of 100 points. The CFT is a verbal fluency test on semantic categories (Delis, Kaplan, & Kramer, 2001), i.e. students were asked to name as many items as possible in the categories of *animals* and *household items* for one minute in both German and English. The number of items from both categories was merged and compared between languages. The scores showed a slight difference between the two languages, English (M = 35.58, SD = 7.29) and German (M = 45.79, SD = 9.95), however, they still scored high in English supporting the results of LexTALE. Paired samples t-tests on the proficiency scores of LexTALE and CFT show statistical difference between the English and German proficiency in LexTALE ($t(23) = -6.65$, p < **.001**) and in CFT ($t(23) = -7.01$, ***p* < .001**).

2.3.3. Materials.

2.3.3.1. Main experiment.

The stimuli in the study were modelled on the study by Conklin et al. (2007), this time manipulating German-English cognates and noncognates. Twenty-four experimental sentences were constructed. An experimental item consisted of three sentences: the first one introduced the animate (*grandma*) and inanimate object (*lamp* - *Lampe*$_{\text{FEM}}$), the second one began with a personal pronoun (*she*), and the third sentence gave more detail about the intention of the animate character (5).

(5) The lamp$_{\text{FEM}}$ will be turned on by the grandma$_{\text{FEM}}$.
She$_{\text{FEM}}$ is at the other end of the room.
The grandma should walk to the lamp to turn it on.

The items were controlled for Word Type (cognate vs. noncognate) and gender Congruency (match vs. mismatch), which can be seen in Table 7. Two lists of the same twelve cognates (*lamp* - *Lampe*) and 12 noncognates (*spoon* - *Löffel*) were used, so that words that matched in list 1 mismatched in list 2. None of the nouns had neuter gender in order to avoid gender congruency with the correct pronoun in English - *it*. In the *cognate match* condition, cognate words were used (*lamp*) that matched in L1 grammatical gender with the pronoun (*Lampe*$_{\text{FEM}}$

- *she*), while *cognate mismatch* condition mismatched in gender (*Lampe*$_{\text{FEM}}$ - *he*). The *noncognate match* condition used noncognate words (*key*) whose L1 German grammatical gender matched in gender with the pronoun (*Schlüssel*$_{\text{MASC}}$ - *he*) and the *noncognate mismatch* condition employed nouns that mismatched in gender with the pronoun (*Schlüssel*$_{\text{MASC}}$ - *she*).

Table 7. The design of the materials for the main experiment (Experiment 1)

		Congruency	
		Match	Mismatch
Word Type	Cognate (COG)	The lamp$_{\text{FEM}}$ will be turned on by the grandma$_{\text{FEM}}$. She$_{\text{FEM}}$ is at the other end of the room.	The lamp$_{\text{FEM}}$ will be turned on by the grandpa$_{\text{MASC}}$. He$_{\text{MASC}}$ is at the other end of the room.
	Noncognate (NC)	The key$_{\text{MASC}}$ will be found by the man. He$_{\text{MASC}}$ is on the other side of the bed.	The key$_{\text{MASC}}$ will be found by the woman. She$_{\text{FEM}}$ is on the other side of the bed.

Twenty-four fillers were constructed in such a way that the pronoun would always refer to the object by using *it* (6). Moreover, in fillers, the second and the third sentence either expressed the location of the inanimate object or used attributive adjective. Filler items were not manipulated for Word Type.

(6) The camera will be returned by the groom.
It is near the tram.
The camera was brand new when bought.

In terms of the visual display, a picture with a character and an object was constructed for each stimulus with a size of 2200x1530 pixels in width and height. (Figure 13). Both the character and the object had a width and a height of maximum 500x700 pixels. On the picture, they were separated by an object (e.g., table or bed), a visible division (e.g., path or river) or were far apart. The object and the character were located as far away as possible from each other on the screen. Pictures for characters were taken from a clipart subscription service (http://www.storyboardthat.com/classroom).

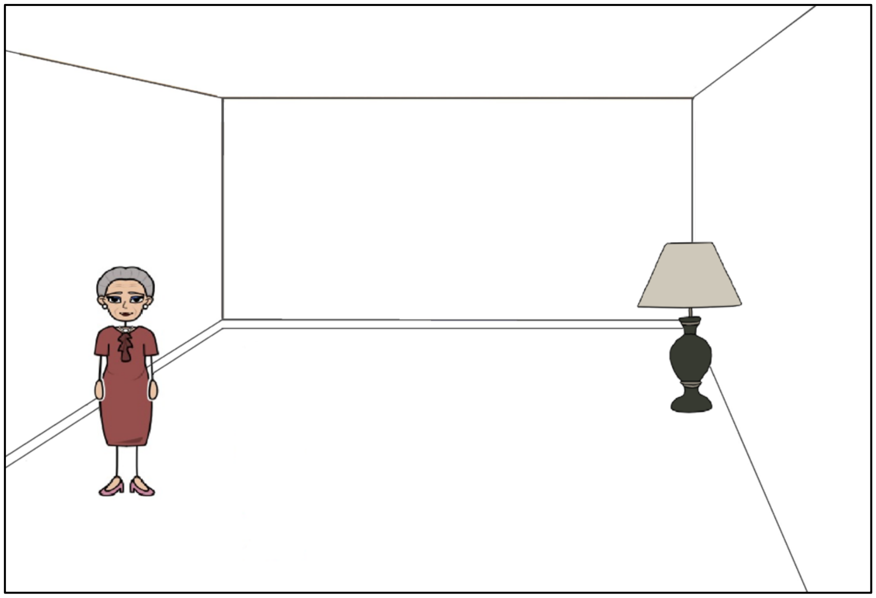

Figure 13. An example of a visual scene in the visual world paradigm

All the sentences were recorded by a native speaker of English at a slow-to-moderate speaking pace. The English native speaker from the United States was a lecturer at a German university and had spent around 10 years studying and working in Germany. The recordings of the sentences were not exactly the same length, but each experimental item took around 11 seconds. For each experimental item, 500 ms of silence would precede the first sentence so that participants have time to see what the visual scene was about. In-between the sentences there would always be a 950 ms break for participants to have enough time to process the information.

2.3.3.2. Control experiments.

Two experiments were administered, the PNT and the LDT, in order to test if the cognate facilitation effect is present in both L1 and L2 during word production and recognition. The PNT was done in L1 German and L2 English. The same experimental items and fillers were used as in the visual world paradigm, i.e. 24 experimental items and 24 fillers. The pictures for objects were colored and taken from a MultiPic databank (Duñabeitia et al., 2018), and they all had the same size (350x350 pixels). All the pictures chosen for the PNT scored more than 75% on naming accuracy when they were given to English (n = 20) and German (n = 20) native speakers who did not take part in the main experiment. The native speakers were given pictures of the objects and were required to write the name of the object.

During the English PNT experiment, a group of L1 German learners saw a picture of an object and were supposed to name it in English. In order to test their knowledge of L1 grammatical gender of German, the participants were told to use the definite article along with the noun in L1 German in the PNT. In this way, their knowledge of L1 gender was tested. Moreover, the task tested naming accuracy for the experimental items, as it was crucial for participants to activate the same word and its gender during the visual world paradigm.

The experimental items were matched on length, frequency and neighborhood size. Frequencies for both English and German words were taken from a SUBTLEX-UK and SUBTLEX-DE database (Brysbaert et al., 2011; Van Heuven, Mandera, Keuleers, & Brysbaert, 2014), and neighborhood size from CLEARPOND (Marian, Bartolotti, Chabal, & Shook, 2012). A one-way ANOVA showed no significant difference between cognates and noncognates in length, frequency or neighborhood size, only a marginally significant difference in German frequency (Table 8).

Table 8. Means (and *SD*) and results of one-way ANOVAs for Word Type across factors like length, frequency and neighborhood size in English and German

	Cognates	Noncognates	ANOVA
Length (ENG)	4.75 (0.75)	4.83 (1.40)	F (1, 22) = 1.61, p = .21
Frequency (ENG)	4.42 (0.49)	4.32 (0.42)	F (1, 22) = 1.94, p = .18
Neighborhood size (ENG)	9.42 (6.78)	8.92 (7.09)	F (1, 22) = 0.81, p = .38
Length (GER)	4.82 (0.72)	7.08 (2.91)	F (1, 22) = 3.52, p = **.07**
Frequency (GER)	2.37 (0.59)	2.36 (0.42)	F (1, 22) = 0.02, p = .88
Neighborhood size (GER)	4.08 (3.94)	2.83 (2.37)	F (1, 22) = 0.7, p = .41

The items were also tested on cognate status by using Van Orden's (1987) calculation for spelling similarity. The L1 word and its L2 translation are compared by using various criteria, e.g. number of single shared letters, the same first letter, and the number of pairs of adjacent letters. If a word's L1 and L2 spelling value is closer to number 1, that indicated that the words are closer to being cognates. A 0 value shows no spelling similarity between L1 and L2, and the words are, therefore, only interpreted as pure translations. An independent t-test showed significant difference between cognate (M = .74, SD = .30) and noncognate (M = .09, SD = .07) spelling (F (1, 22) = 12.27, p < **.001**).

An LDT also tested cognate facilitation effects, but this time during word recognition. The LDT used the same items that were used in the visual world paradigm, i.e. 24 experimental items. Twenty-four non-words were added. Twelve of the non-words were pseudo-words that look like possible English/German words, and 12 were non-words which are made out of illicit sound combinations in a target language (Appendix A).

2.3.4. Procedure.

2.3.4.1. Main experiment.

Participants first performed the visual-paradigm task, followed by the PNT and the LDT. After providing their consent, the participants were seated in front a 22-inch screen with a resolution of 1280 x 1024 pixels. The eye movements were recorded with a SMI RED eye tracker, sampling at 60 Hz, and with a spatial resolution of up to 0.5 degrees of angle. The participants were presented with a visual scene accompanied by an English discourse and were instructed to observe and listen. On several occasions, participants were asked to answer a question about what they had previously heard in the experiment. The questions required a brief answer about the most recent picture in English. The aim of the questions was to keep participants focused on the task, as the eye tracking task lasted around 20 minutes and it was mostly passive.

2.3.4.2. Control experiments.

The PNT was run in E-Prime (Schneider, Eschman, & Zuccolotto, 2002) on a Lenovo Win7 PC laptop which was connected to a Serial Response Box (SR Box). The SR Box was connected to a microphone which was triggered by the participants' voice. During the picture presentation, participants had 3500 ms to name the object. Before the presentation of each object, a fixation cross appeared in the middle of the screen. As soon as the object was named, the voice onset triggered the SR Box which recorded the RTs and showed the next picture in line. In case the participants were not able to name the object in a given time, a sign "TOO SLOW" was presented on the screen, followed by a fixation cross, and then a new picture was presented.

When it came to the LDT, two tasks were administered: one in German and one in English. The tasks were created in E-Prime, they lasted around 3 minutes each and participants were instructed to look at a screen where individual words would be presented to them. They were expected to decide if the word was an existing word in the target language

(German or English). All the words were in capital letters, as I wanted to exclude German conventions (i.e., writing a noun with a capital letter) from the experiment. Participants had 3500 ms to answer by pressing a button marked for 'yes' and a button marked for 'no'. Indicating whether they were not fast enough, the sign "TOO SLOW" was presented on the screen, followed by a fixation cross and then a new word was presented.

2.3.5. Results.

2.3.5.1. Lexical decision task.

In the LDT, participants had 3500 ms to decide whether a word written on the screen is an existing word in the target language. RTs that were faster than 200 ms and slower than 1500 ms were excluded from the analysis. This affected 1.58% of the data. Moreover, inaccurate responses were also excluded from the analysis, affecting 1.22% of the data. The percentage of correct responses for cognates and noncognates in English and German is presented in Table 9. In order to see if the accuracy of responses was significantly different between the English and German LDT and between cognates and noncognates, a logistic mixed effects regression, a *glmer* function in *lme4* package (Bates, Maechler, Bolker, & Walker, 2015), was used with Word Type and Language as fixed effects, and Item and Participant as random intercepts. The analysis was done in *R Studio Version 3.4.3* (R Core Team, 2017). The model showed no significant effects of Word Type (β = -1.01, SE = 0.69, z = -1.47, p = .14), Language (β = -0.29, SE = 0.77, z = -0.37, p = .71) and a Word Type by Language interaction (β = 1.30, SE = 1.03, z = 1.26, p = .21).

Table 9. The LDT word accuracy in percentage (and *SD*) in English and German (n = 24)

	Cognates	Noncognates
English	99% (10%)	97% (17%)
German	99% (12%)	99% (10%)

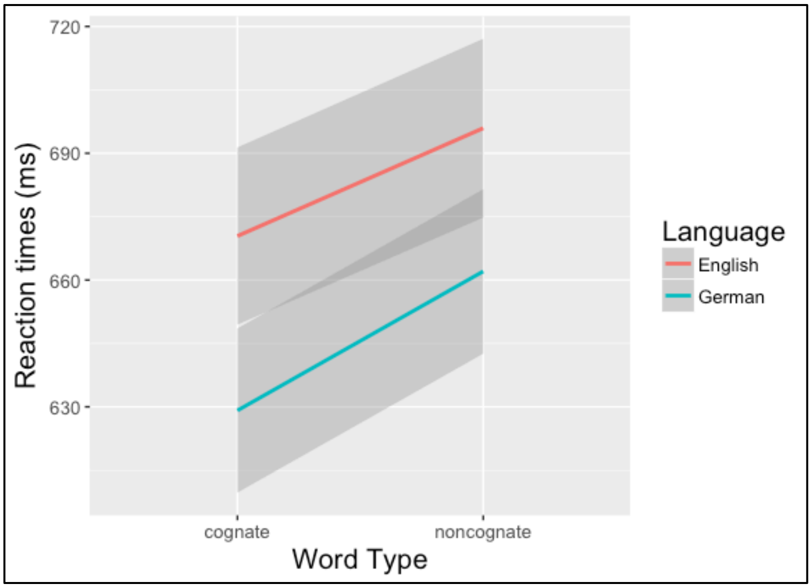

Figure 14. The LDT reaction times (in ms) for L1 German and L2 English by Word Type (n = 24)

Figure 14 displays RTs for cognates (M = 670, SD = 171) and noncognates (M = 695, SD = 185) for LDTs in English and cognates (M = 629, SD = 157) and noncognates (M = 662, SD = 173) in German. The figure displays shorter RTs for cognates and longer RTs for noncognates in both tasks. A linear mixed effects model, a *lmer* function in *lme4* package (Bates et al., 2015), was used with Word Type and Language as fixed effects, and Item and Participant as random intercepts, this time to see if there are any differences in RTs between LDT tasks and word types. The model found no effects of Word Type (β = 25.58, SE = 19.07, t = 1.34, p = .19) nor a Word Type by Language interaction (β = 9.96, SE = 17.25, t = 0.58, p = .56), but only found a main effect of Language (β = -42.59, SE = 12.17, t = -3.5, p < **.001**). Therefore, L1 German learners read the L1 German items more quickly, regardless of Word Type.

2.3.5.2. Picture naming task.

In the PNT, participants were required to name an object on the screen in under 3500 ms. Only the name of the object was named for the L1 English, while in the L2 German task an NP was required (definite determiner+noun). Incorrect naming, accidental voice trigger responses, and responses faster than 200 ms and slower than 1500 ms were excluded (9.64%). The results of naming accuracy are presented in Table 10. A generalized linear mixed model with fixed factors (Word Type and Language) and random intercepts (Item and Participant) revealed a main effect of Word Type (β = -1.66, *SE* = 0.34, *z* = -4.86, *p* < **.001**) and a marginally significant effects of Language (β = 0.87, *SE* = 0.45, *z* = 1.92, *p* = **.06**). No interaction was found of Word Type and Language (β = 0.40, *SE* = 0.52, *z* = 0.76, *p* = .45). This means that L1 German learners were more accurate at naming cognates than noncognates in English and German, and were overall more successful in naming items in their L1.

Table 10. The PNT word accuracy in percentage (and *SD*) in English and German (*n* = 24)

	Cognates	Noncognates
English	94% (23%)	77% (42%)
German	98% (15%)	92% (27%)

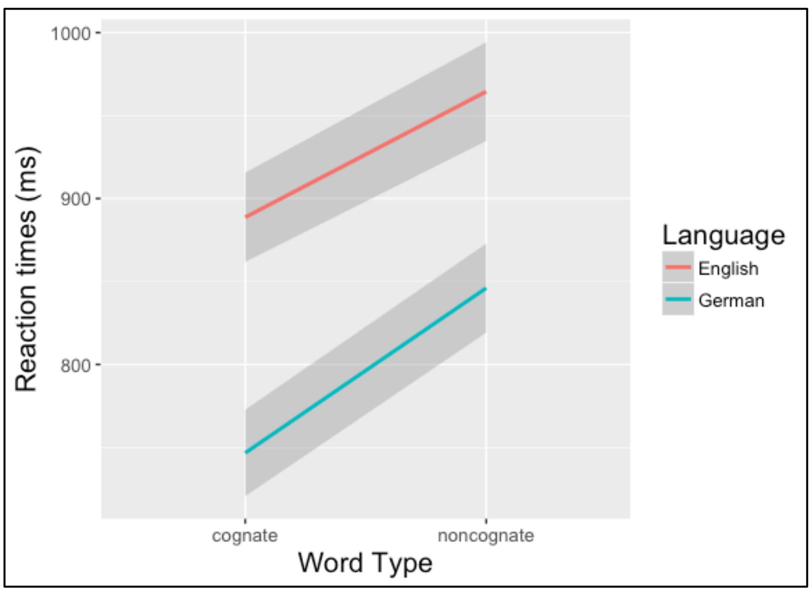

Figure 15. PNT reaction times (in ms) for L1 German and L2 English by Word Type (*n* = 24)

Figure 15 shows naming times for the PNT in L2 English and L1 German, and shows longer RTs for items in the L2. Also, cognates are named faster in both LDTs (English: *M* = 888, *SD* = 217; German: *M* = 746, SD = 189) than noncognates (English: *M* = 964, *SD* = 234; German: *M* = 846, *SD* = 251). A linear effects model with Word Type and Language as fixed effects and Item and Participant as random intercepts showed a significant effect of Word Type (β = 82.28, *SE* = 34.95, *t* = 2.35, *p* = **.03**) and a highly significant main effect of

Language (β = -143.92, SE = 17.23, t = -8.35, p < **.001**). There was no interaction of Word Type by Language (β = 22.94, SE = 25.30, t = 0.91, p = .36). Thus, the learners were faster at naming cognates in both PNTs and were overall faster at naming L1 items.

2.3.5.3. Main experiment.

We now turn to the visual world paradigm. Considering that the study is looking at L1 grammatical gender co-activation, the crucial time of interest is the pronoun in the second sentence. By looking at the proportion of fixations right after the onset of the pronoun, we can understand more if L2 English learners used L1 or L2 gender information. Since it takes around 200 ms for auditory information to be fully processed and implemented in eye-movements (Matin, Shao, & Boff, 1993), we will look at two time windows (TWs): (i) from 300 ms before to 200 ms after the pronoun, and (ii) from 200 ms to 700 ms after the pronoun.

Logistic regression model, i.e. *glmer* function in *lme4* package (Bates et al., 2015), was computed in *R Studio Version 3.4.3* (R Core Team, 2017) was used for the analysis of the proportion of fixations with Word Type, Congruency and Trial number as fixed effects as well as their interaction. As for random effects, I used random intercepts for Participant and Item, and by-participant and by-item random slopes for Congruency.

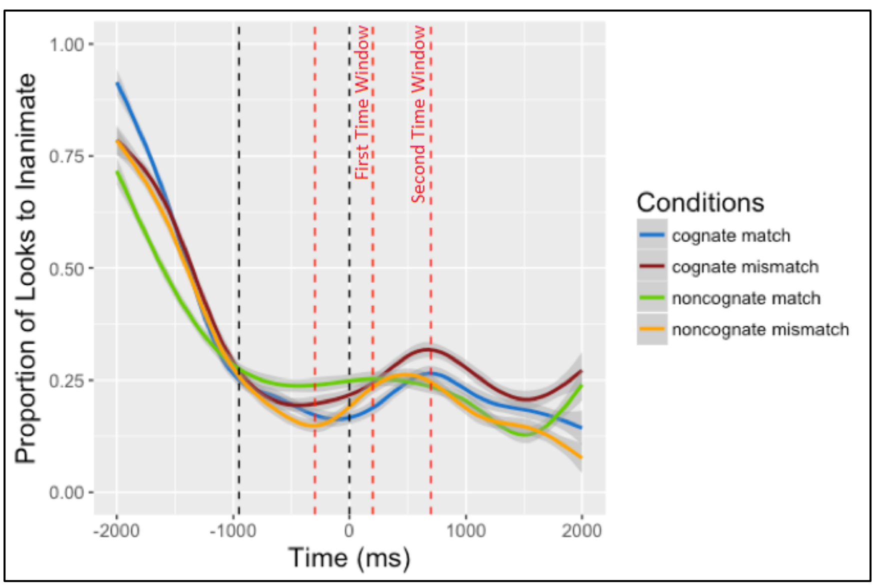

Figure 16. Fixation proportions to the inanimate object in four conditions (i.e., cognate match, cognate mismatch, noncognate match and noncognate mismatch) during the visual world paradigm (n = 24). The timeline of the experiment is shown in milliseconds; 0 represents the onset of the pronoun. The first black dotted line shows the end of the first sentence, the second black dotted line represents the onset of the pronoun, and the red dotted lines label two time windows that were analyzed.

As seen in Table 7, there were four conditions based on Word Type (cognates vs. noncognate) and Congruency (congruent vs. incongruent). Regarding cognates, the difference between match and mismatch condition in both time windows is not prominent. For instance, *cognate match* condition used cognates between L1 and L2 (e.g., *lamp*) that matched in L1 grammatical gender with the pronoun (*Lampe*$_{\text{FEM}}$ - *she*); *cognate mismatch* condition used cognates that mismatched in gender (*Lampe*$_{\text{FEM}}$ - *he*); *noncognate match* condition used noncognate words (e.g., *key*) whose L1 German grammatical gender matched in gender with the pronoun (*Schlüssel*$_{\text{MASC}}$ - *he*) and *noncognate mismatch* condition used nouns that mismatched in gender with the pronoun (*Schlüssel*$_{\text{MASC}}$ - *she*). Figure 16 shows the proportion of fixations towards the inanimate noun (*lamp*) in four conditions according to Word Type and Congruency factors. The *x* axis shows the timeline of the experiment in milliseconds and marks the onset of the pronoun as the point zero. However, there seems to be some congruency effect in the case of noncognates in the first time window, but the lines start diverging 1000 ms before the onset of the pronoun and overlap again in the second window.

The model shows that in the first time window, a main effect of Trial was found (see Table 11 for results). Moreover, a marginally significant interaction of Congruency and Word Type was recorded, as well as a highly significant Congruency by Trial and a Word Type by Trial interaction. There was also a three-way interaction of Congruency, Word Type and Trial. Based on Figure 16, an interaction of Congruency and Word Type in TW1 is seen in differences between conditions in the case of noncognates, as the proportion of looks to the inanimate is higher for match than mismatch items.

Table 11. The output from the generalized linear-mixed effects models run on TW1 for L1 German group (*n* = 24). The fixed factors included: Congruency (match vs. mismatch), Word Type (cognate vs. noncognate) and Trial.

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-3.76	0.89	-4.20	< .001
Congruency	0.91	0.67	1.36	.17
WordType	1.45	0.89	1.63	.10
Trial	-0.32	0.10	-3.32	**.001**
Congruency*WordType	-1.50	0.88	-1.71	**.09**
Congruency*Trial	0.59	0.13	4.71	**.001**
WordType*Trial	0.48	0.11	4.29	**.001**
Congruency*WordType*Trial	-0.63	0.15	-4.18	**.001**

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

In the second time window, main effects of Congruency, Word Type and Trial were found (Table 12). When it came to interactions, I found the following interactions: a marginally significant Congruency and Word Type interaction; Congruency and Trial; Word Type and Trial; as well as Word Type, Congruency and Trial interaction. Even though the model found the interaction of Congruency and Word Type, Figure 16 shows a slightly higher proportion of looks for cognates that mismatch than for cognates that match. Because there was a three-way interaction of Word Type, Congruency and Trial, a follow up analysis will be performed on noncognates and cognates individually, in order to explore the significance in more detail.

Table 12. The output from the generalized linear-mixed effects models run on TW2 for L1 German group (*n* = 24).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-5.14	1.36	-3.78	< .001
Congruency	3.08	1.05	2.94	**.003**
WordType	2.77	1.34	2.07	**.04**
Trial	-2.58	0.19	-13.88	**.001**
Congruency*WordType	-2.60	1.30	-2.00	**.05**
Congruency*Trial	2.16	0.20	10.84	**.001**
WordType*Trial	2.78	0.19	14.28	**.001**
Congruency*WordType*Trial	-2.32	0.22	-10.77	**.001**

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

When excluding Word Type from the model, and splitting the analysis into two separate analysis for either cognates and noncognates, the model shows a main effect of Congruency ($\beta = 2.46$, $SE = 1.09$, $z = 2.25$, $p =$ **.02**) and an interaction of Congruency and Trial ($\beta = 0.65$, $SE = 0.15$, $z = 4.50$, $p <$ **.001**) for cognates in TW1. The main effect of Congruency is seen in a higher number of fixations for mismatch cognates. The analysis of noncognates shows no effect of Congruency nor an interaction of Congruency and Trial. This means that there was no difference between the fixations on match versus mismatch noncognates. As for TW2, a main effect of Congruency ($\beta = 3.33$, $SE = 1.12$, $z = 2.97$, $p =$ **.003**) was found for cognates, followed by a Congruency by Trial interaction ($\beta = 2.15$, $SE = 0.20$, $z = 10.89$, $p <$ **.001**). Similarly to TW2, the main effect of Congruency argues for a higher number of fixations for the mismatch items. The analysis on noncognates did not reveal any significant effects (see results of models in Appendix A). Considering that Trial was found as the main effect, but it also interacted with Word Type and Congruency in both time windows, this might suggest some changes during the experiment. Therefore, in further analysis I decided to split the experiment in two halves (first and last) in order to explore the effects of Trial.

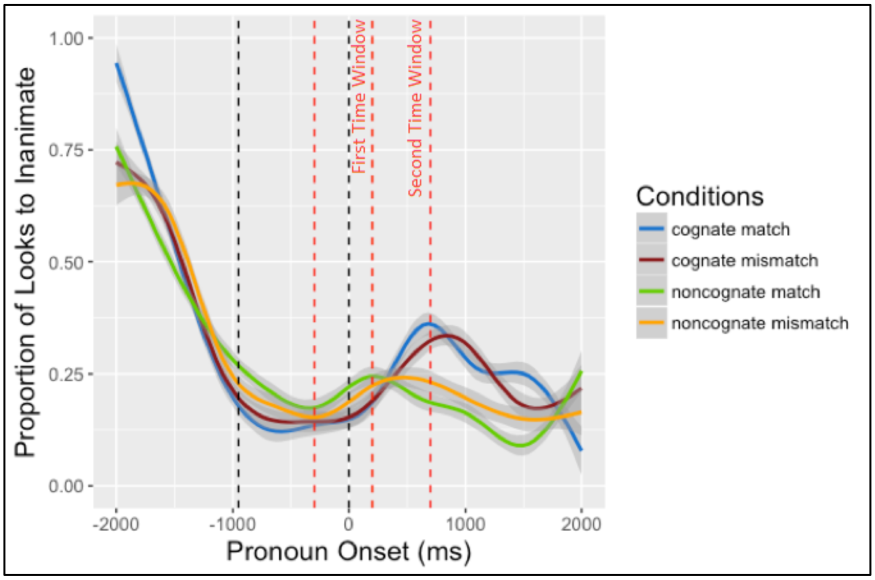

Figure 17. Experiment 1: Fixation proportions to the inanimate object in four conditions of the first half during the visual world paradigm (*n* = 24)

Figure 17 shows the proportions of fixations in the first half of the experiment. There seems to be almost no differences between match and mismatch conditions for cognate and noncognates. TW2 show a slightly bigger differences between the conditions, which does not seem to be significant. The differences would be a higher proportion of looks for match items when it comes to cognates, and a higher proportion of looks for mismatch items in the case of noncognates. A generalized fixed effects model was run on TW1 of the first half with Congruency and Word Type as fixed factors and Participant and Item as random effects (Table 13). The only main effect found was of Word Type, which could be seen in the higher proportion of looks for noncognates.

Table 13. The output from the generalized linear-mixed effects models run on TW1 of the first half for the L1 German group (*n* = 24).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-12.14	3.36	-3.61	< .001
Congruency	-1.61	3.23	-0.50	.62
WordType	8.92	3.65	2.45	**.01**
Congruency*WordType	-4.02	3.22	-1.25	.21

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

Another model was run on TW2 of the first half of the experiment and it revealed a main effect of Congruency (Table 14). It is still not clear from the graph in which direction the main effect goes, however, the interaction of interest is between Congruency and Word Type, which was not found in TW2 of the first half.

Table 14. The output from the generalized linear-mixed effects models run on TW2 of the first half for the L1 German group (*n* = 24).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-4.48	2.58	-1.74	.08
Congruency	-7.35	2.96	-2.49	**.01**
WordType	-0.34	2.93	-0.12	.91
Congruency*WordType	1.46	4.66	0.31	.75

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

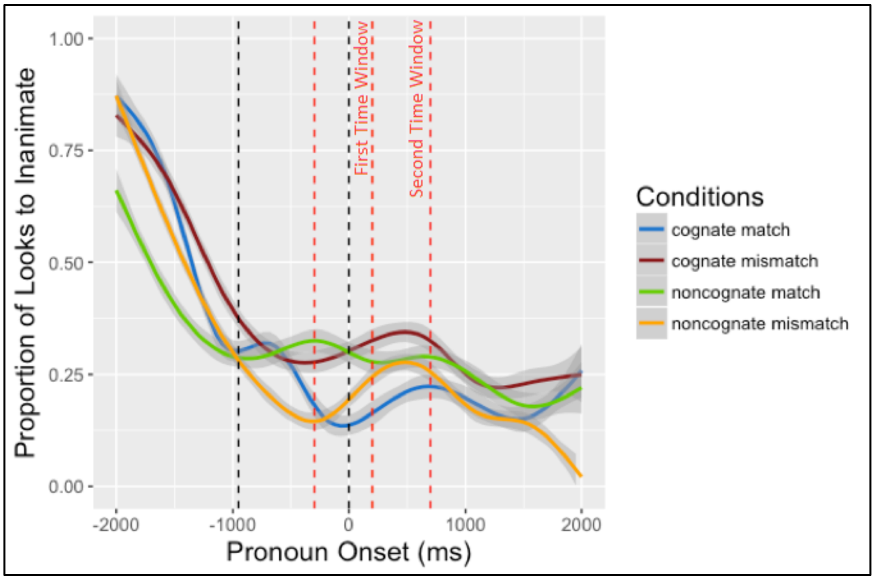

Figure 18. Experiment 1: Fixation proportions to the inanimate object in four conditions of the second half during the visual world paradigm (*n* = 24).

In Figure 18, the second half of the experiment shows increased looks to matched cognates as opposed to mismatched cognates in TW1 and TW2. There are also increased looks to noncognates that match but only in TW1. The model run on TW1 of the second half reveals a marginally significant main effect of Congruency (Table 15). A Congruency by Word Type interaction was not found.

Table 15. The output from the generalized linear-mixed effects models run on TW1 of the second half for the L1 German group (*n* = 24).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-11.81	3.79	-3.12	.002
Congruency	6.16	3.61	1.71	**.09**
WordType	2.98	3.81	0.78	.44
Congruency*WordType	-1.53	3.80	-0.40	.69

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

The analysis on TW2 also revealed a main effect of Congruency (Table 16), which could be seen in lower proportion of looks towards matched items. Because there was no interaction of Congruency and Word Type, the data was not analyzed further.

Table 16. The output from the generalized linear-mixed effects models run on TW2 of the second half for the L1 German group (n = 24).

	Estimate	SE	z-value	p-value
(Intercept)	-11.10	3.28	-3.39	< .001
Congruency	7.42	3.08	2.41	**.02**
WordType	3.59	3.01	1.19	.23
Congruency*WordType	-2.12	2.85	-0.74	.46

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

Even though the results show an interaction of Congruency and Word Type in both time windows (although a marginally significant interaction in TW1), the effects did not advocate for more fixations towards cognates that matched in gender with the pronoun. Because there was also a three-way interaction of Congruency, Word Type and Trial, the data was split in half based on the trial order, ending up with the first and the second half of the experiment. The follow up analyses did not find an interaction of Congruency by Word Type, only a main effect of Congruency, and for this reason the data were not further analyzed.

2.3.6. Discussion.

The LDT and the PNT tasks were introduced on order to test the cognate facilitation effect, and only the PNT was able to find the effect in English and German. No main effect of Word Type was found in the LDT, which means that the cognates were not read faster than noncognates in the L1 and in the L2. Although the effect was not visible in word comprehension, the fact that it was detected in word production supports that the lexical co-activation of the L1 is manifested in the L2. In the visual eye tracking experiment, there were marginal interactions of Congruency and Word Type in both time windows, but were seen in a higher proportion of looks for mismatched cognates, rather than matched cognates. The fixed factor Trial interacted with Congruency and Word Type in a three-way interaction in both TW1 and TW2. Yet, the follow up analyses on the first and second half did not reveal an interaction of Congruency by Word Type.

Considering that the gender congruency effect with words that overlap in word form (cognates) was not found, the results did not replicate the study by Conklin et al. (2007). One of the possibilities is that, during bottom-up processing, L1 gender was not sufficiently activated in order to be transferred during L2 online processing. Therefore, Experiment 2 deals with additional top-down activation of L1 which will in turn lead to a bottom-up activation of grammatical gender by introducing a language-mixing context. In the language-mixing task, the first sentence which includes the object and the character will be introduced in the L1, which should heighten the activation of the L1 and the bottom-up activation of L1 gender. In this way, the L1 grammatical gender will be activated, but what is left to see is if the gender will be recruited during L2 gender agreement processing of the pronoun. The next section describes the language-mixing study in detail.

2.4. Experiment 2: L1 Grammatical Gender Co-Activation in a Language-Mixing Context

2.4.1. Overview and research questions.

Having in mind that Experiment 1 failed to replicate the study by Conklin et al. (2007) with adult L1 German L2 English learners, Experiment 2 aims at exploring whether heightened L1 activation is needed for L1 co-activation to happen. In other words, the study aimed at investigating if additional levels of top-down L1 activation, by introducing a language-mixing context, are needed for the L1 grammatical gender to get activated. Moreover, considering that the area of bilingual word production seems to have mixed results regarding the type of languages (Romance vs. Germanic), this experiment introduces languages from both language groups (Spanish and German) with an addition of a Slavic language (Croatian). The three languages (see Table 17 for summary) also differ according to the realization of grammatical gender, namely, German and Croatian have three grammatical genders (masculine, feminine and neuter), while Spanish has only two (masculine and feminine), which means that German and Croatian are more complex than Spanish as there are more values to be assigned to nouns. In terms of gender assignment complexity, German has various small-scope rules that have many exceptions and for that reasons is labelled as phonologically opaque (Corbett, 1991), while Croatian and Spanish are phonologically transparent (Teschner & Russell, 1984) and, therefore, simpler when it comes to language assignment rules. In terms of language selection, German and Croatian are classified as early-selection languages as they do not need to access phonological information in order to select the determiner of the noun, or to compute the correct gender agreement. Spanish, on the other hand, has to look at phonological context in order to select the appropriate determiner, which delays the process of gender retrieval during gender agreement.

Table 17. Summary of the gender feature in Croatian, Spanish and German

	Croatian	Spanish	German
Language family	Slavic	Romance	Germanic
Gender values	masculine	masculine	masculine
	feminine	feminine	feminine
	neuter		neuter
Phonological transparency	transparent	transparent	opaque
Language selection	early	late	early

I pose the following research questions and propose the corresponding hypotheses:

Research question 1: Are additional levels of top-down L1 activation needed for the L1 grammatical gender co-activation to happen?

Hypothesis 1: The additional activation of L1 will facilitate L1 grammatical gender activation.

Research question 2: Are there differences in L1 grammatical gender co-activation depending on the realization of grammatical gender in L1?

Hypothesis 2: L1s with a different realization of grammatical gender will act differently in the activation of L1 grammatical gender in the L2.

The study predicts that L1 grammatical gender will get activated in the L2 which lacks the feature. Lexical overlap is hypothesized to have an effect during L1 grammatical co-activation as it has stronger links between languages and helps heighten the possibility of crosslinguistic influence. The heightened top-down L1 activation during L2 gender agreement processing will aid the co-activation of L1 gender during gender agreement, which will be seen only with cognates. The first hypothesis is concerned with the activation of L1 under specific conditions, while the last hypothesis looks at crosslinguistic differences between languages that might affect the recruitment of L1 gender during L2 online processing.

I predict differences in L1 groups according to gender selection, as previous research has shown that native speakers of Germanic languages have no issues in retrieving L1 gender during word production and recognition and sentence comprehension (Bordag & Pechmann, 2007; Conklin et al., 2007; Lemhöfer et al., 2008; Salamoura & Williams, 2007). Speakers of Romance languages showed mixed results, with a strong evidence for the absence of L1 grammatical gender co-activation during gender agreement in word production for Spanish, Catalan and Italian languages (Costa et al., 2003). Native speakers of Slavic languages have not been that much studied, and for this reason Croatian is introduced as an additional L1 in the study. Studies on Slavic languages have so far shown the lack of effect in word production for NPs (for Czech see Bordag & Pechmann, 2007; for Croatian see Costa et al., 2003) and an effect only with animate nouns during a self-paced study (Cook, 2018). However, Croatian is classified as an early-selection languages (like German), and is expected to show evidence for L1 co-activation. Because there is not enough research with Slavic languages and because Croatian is supposed to be selected early in the process (which is opposed to what research has shown), investigating the Croatian language is a good way to disentangle possible factors in the process of L1 grammatical gender co-activation. The following section deals with participants of all three L1s in more detail.

2.4.2. Participants.

Three groups with different L1s (Croatian, Spanish, German) were tested. The first group consisted of 41 L1 Croatian L2 English learners (32 female) tested at the University of Rijeka in Croatia. All were students of English as their major or minor subject with a mean age of 21.83 (*SE* = 2.1, range = 19–29 years). None of the students were early bilinguals, even though some of them had a general knowledge of Italian, German and Spanish (Table 18). The average age of learning English was 6.61 (*SD* = 2.76, range: 2 – 15 years) and by the time they took part in the experiment, they had been learning English for 14.56 years (*SD* =

3.89, range: 5 – 23 years). The LexTALE (Lemhöfer & Broersma, 2012) and the CFT (Delis et al., 2001) were used as L1 and L2 proficiency measures and they were all the same as in Experiment 1, aside from LexTALE in Croatian. So far, no Croatian LexTALE was made, however, in their paper, Lemhöfer and Broersma (2012) provided guidelines they have followed for creating a LexTALE. Therefore, 63 items were taken from the Croatian web corpus (hrWaC), 3 of them being practice items, 40 of them Croatian words of different word frequency and 20 of them were Croatian nonwords (see Appendix A: III). Similarly to other LexTALE tests, nonwords were based on existing Croatian words by changing 2 letters in order to make the words appear plausible in L1. As for existing Croatian words, 40 of the words had to have a mean frequency of between 1 and 26 occurrences per million, ranging from highly frequent to very infrequent. Words were divided into word classes: 15 nouns, 12 adjectives, 2 adverbs, 1 verb, 2 verb participles, and 8 words that can be classified into two different classes (e.g., a noun and a verb).

The LexTALE results showed a high proficiency of L2 English ($M = 83.93$, $SD = 8.07$, range: 68.75 – 97.5) and even higher proficiency in Croatian ($M = 92.41$, $SD = 7.71$, range: 68.75 – 100). The CFT showed similar results in English ($M = 33.95$, $SD = 7.12$, range: 19 – 51) and Croatian ($M = 42.34$, $SD = 6.82$, range: 26 – 55). A paired samples t-test on the proficiency scores between participants' L1 and L2 showed a significant difference in LexTALE ($t(40) = -5.656$, $p <$ **.001**) and the CFT ($t(40) = -8.587$, $p <$ **.001**).

Table 18. Experiment 2. L1 Croatian, Spanish and German participant information and statistical difference between L1 groups.

	L1 Croatian (n = 41)			**L1 Spanish** (n = 25)			**L1 German** (n = 24)			**One-way ANOVA**
	Mean	Range	*SD*	Mean	Range	*SD*	Mean	Range	*SD*	
Age (in years)	21.83	19 – 29	2.1	25.13	20 – 34	3.98	25.08	20 – 37	4.16	F (2, 86) = 11.06, p < **.001**
Age of onset (in years)	6.61	2 – 15	2.76	7.17	3 – 25	4.28	8.58	5 – 12	1.69	F (2, 86) = 3.301, p = **.04**
Years of learning L2 (score/max 100)	14.56	5 – 23	3.89	14.21	2 – 21	5.46	13.29	7 – 22	3.44	F (2, 86) = 0.691, p = .50
English LexTALE (score/max 100)	83.93	68.75 – 97.5	8.07	72.5	65 – 86.25	5.55	82.92	56.25 – 97.5	11.18	F (2, 86) = 14.99, p < **.001**
L1 LexTALE (score/max 100)	92.41	68.75 – 100	7.71	94.27	84.83 – 100	4.11	91.4	82.5 – 100	7.97	-
English CFT (words/minute)	33.95	19 – 51	7.12	32.88	27 – 47	7.62	35.58	25 – 48	7.29	F (2, 86) = 0.84, p = .44
L1 CFT (words/minute)	42.34	26 – 55	6.82	47.88	29 – 64	9.91	45.79	29 – 69	9.95	-

The second group consisted of 25 L1 Spanish L2 English learners (18 female) with a mean age of 25.13 (*SD* = 3.98, range: 20 – 34 years). The students were recruited at the University of Granada in Spain, and not all of them were students of English. The mean age of English acquisition was 7.17 (*SD* = 4.28, range: 3 – 25 years) and mean years of learning 14.22 (*SD* = 5.46, range: 2 – 21 years). The same measures were used for L2 English proficiency, however, L1 Spanish LexTALE was adopted as in a study by Izura, Cuetos and Brysbaert (2014). In this version of LexTALE, 90 words were selected with different frequencies from the SUBTLEX-Esp corpus (Cuetos, Glez-Nosti, Barbón, & Brysbaert, 2011). English LexTALE results were slightly lower than the other two L1 groups (*M* = 72.5, *SD* = 5.55, range: 65 – 86.25), while the Spanish LexTALE results indicated high proficiency (*M* = 94.27, *SD* = 4.11, range: 84.83–100). English CFT showed a mean of 32.88 (*SD* = 7.62, range: 27 – 47) and Spanish CFT 47.88 (*SD* = 9.91, range: 29 – 64). There was a significant difference between L1 and L2 proficiency in the LexTALE ($t(24) = -22.65$, $p <$ **.001**) and the CFT ($t(24) = -14.22$, $p <$ **.001**).

Twenty-four L1 German L2 English learners (14 female) with a mean age of 25.08 years (*SD* = 4.42, range: 20 – 37 years) were recruited at the University of Braunschweig. They were all students of English. They had started learning English approximately at the age of 8, and they had been learning it for 13 years mostly in a formal setting. The students were tested on their knowledge of English and German with the same tests as in the pilot study (i.e., LexTALE and CFT). L1 German L2 English learners scored high in both the English (*M* = 82.92, *SD* = 11.18) and the German version of LexTALE (*M* = 91.4 *SD* = 7.97). The CFT scores showed a similar result as LexTALE tests, with English scores (*M* = 35.58 *SD* = 7.29) lower than German (*M* = 45.79 *SD* = 9.95). Paired samples t-tests on the proficiency scores between participants' L1 and L2 showed a significant difference in LexTALE ($t(23) = -6.654$, $p <$ **.001**) and the CFT ($t(23) = -7.006$, $p <$ **.001**). Table 18 summarizes participant information and proficiency scores for all three L1 groups.

Having in mind that the first two groups displayed similar English LexTALE results and were students of English, a one-way ANOVA was used in order to find if there are some significant differences between groups. The test showed a significant difference between the three groups on the English LexTALE (F (2, 86) = 14.99, $p <$ **.001**). A two-sample t-test showed that there were no differences between L1 German and L1 Croatian groups (t (37) =

.39, *p* = .7). However, English LexTALE scores differed between L1 Spanish and L1 Croatian group (t (61) = 6.74, p < **.001**) and L1 Spanish and L1 German group (t (33) = 4.09, p < **.001**). The results indicate lower L2 proficiency for Spanish learners of English when compared to the German and Croatian group. However, a one-way ANOVA for the CFT showed no statistical difference between the groups (F (2, 86) = 0.84, p = .44). The difference in LexTALE English proficiency will be taken into account as a possible factor when interpreting the results.

2.4.3. Materials.

2.4.3.1. Main experiment.

The task was similar to the one in the pilot study, with a difference in the language of the first sentence and with slightly different items. The aim of the current study is to investigate (i) whether language mixing heightens the activation of grammatical gender, (ii) whether the activation will happen only where there is lexical overlap and (iii) if languages that differ in gender values act differently when it comes to L1 grammatical gender co-activation during L2 gender agreement. In Experiment 2, the first sentence for the experimental items was always presented in participants' L1. Therefore, the first sentence *The lamp will be turned on by the grandma* for Figure 12 would look like in the example (7):

(7) a. Lampa$_{\text{FEM}}$ će biti upaljena od strane starice. (Croatian)
Lamp will be turned on from side grandma.
b. La lampara$_{\text{FEM}}$ será encendida por la abuela. (Spanish)
The lamp will be turned on from the grandma.
c. Die Lampe$_{\text{FEM}}$ wird von der Oma angeschaltet. (German)
The lamp will from the grandma turned on.

The rest of the experimental items, including the sentence with the critical pronoun, were presented in English. An example of an experimental item (8) in Croatian is given below:

(8) Lampa će biti upaljena od strane starice.
She is at the other end of the room.
The grandma should walk to the lamp to turn it on

In the experiment with L1 Croatian learners and L1 Spanish learners, 32 experimental items and 32 fillers were used. This equated to 16 cognates and 16 noncognates in two lists. Words that matched in list 1 mismatched in list 2. Words with a neuter gender value were excluded from the experiment, which was not a problem as there are not many neuter words in Croatian. Because it was very difficult to find cognate and noncognate words in German that do not have a neuter gender, the experiment consisted of only 24 experimental items (12 cognates and 12 noncognates in two lists).

Therefore, the German-English experiment had 24, Croatian-English 32 and Spanish-English 32 fillers. The items were controlled for Word Type (cognate vs. noncognate) and Congruency (match vs. mismatch). The same design of the materials as in Experiment 1 was applied in Experiment 2, with four conditions: cognate match, cognate mismatch, noncognate match, noncognate mismatch. Table 19 gives an example of 4 conditions with L1 as Croatian:

Table 19. The design of the materials for the main experiment (Experiment 2)

		Congruency	
		Match	Mismatch
Word Type	Cognate (COG)	Lampa$_{\text{FEM}}$ će biti upaljena od strane starice$_{\text{FEM}}$. She$_{\text{FEM}}$ is at the other end of the room.	Lampa$_{\text{FEM}}$ će biti upaljena od strane starca$_{\text{MASC}}$. He$_{\text{MASC}}$ is at the other end of the room.
	Noncognate (NC)	Ključ$_{\text{MASC}}$ će biti pronađen od strane muškarca$_{\text{MASC}}$. He$_{\text{MASC}}$ is on the other side of the bed.	Ključ$_{\text{MASC}}$ će biti pronađen od strane žene$_{\text{FEM}}$. She$_{\text{FEM}}$ is on the other side of the bed.

In the fillers, the second or the third sentence was presented in the participants' L1. Unlike the experimental items, the pronoun in the fillers only referred to the object and not to the character. In this way, the experiment was counterbalanced, and the participants should not have been biased towards looking at the character. In those fillers where the second sentence was translated, the pronoun always referred to the object. For instance, if the object was 'pencil' which is a feminine noun in Croatian (*olovka*$_{\text{FEM}}$), the pronoun was 'she' or *ona*$_{\text{FEM}}$ in Croatian. That also meant the character in this case should never have the same gender as the object, so that it does not create confusion with participants. When the third sentence was translated, and that means the first and the second sentence were in English, the second sentence used the pronoun *it,* which disambiguates what the pronoun refers to. In (9), an example of a filler item in L1 Croatian with the second sentence ('She$_{\text{FEM}}$ is new$_{\text{FEM}}$.') in L1 is shown.

(9) The pencil will be tested by the stewardess.
Ona$_{\text{FEM}}$ je nova$_{\text{FEM}}$.
The pencil is closer to the microphone than to the stewardess.

The most difficult part of the eye tracking experiment was finding balanced early bilinguals that have one of the languages (German, Croatian, Spanish) as their L1 and English as their L2, or vice versa, for the recordings. For the German-English task, an English native with a very good German knowledge and speaking skills was used for the recordings. The speaker was a lecturer at the German university, originally from the US, and had spent around 10 years studying and working in Germany. For Croatian recordings, a native speaker of Serbian was used, as it was almost impossible to find a Croatian in a short amount of time with a good English knowledge. The L1 Serbian speaker was also a lecturer of English at a German university, which lowered the chances of having a strong accent in English. However, special care was taken in using Croatian words in the experiment, in order for Serbian language not to have a possible effect on the experiment outcomes. A Spanish native speaker from Spain who also was an English lecturer at a German university was recorded for the Spanish-English language mixing experiment. All the speakers were female, which is also important for eliminating possible gender effects between experiments. Similarly to Experiment 1, 500 ms of silence preceded the first sentence and in-between the sentences there was always a 950 ms break for participants, so that participants had enough time to process the information and launch eye movements.

2.4.3.2. Control experiments.

The control experiments comprised both the LDT and the PNT. The PNT used the same nouns that were used in the visual world task. The same number of experimental items and filler words was used, which is altogether 62 items in Croatian, 62 items in Spanish and 48 items in German. The pictures for PNT were taken from a MultiPic databank (Duñabeitia et al., 2018), and they all had the same size (350x350 pixel). Only the pictures which were named accurately 75% of the time by 20 native speakers of the respective languages were chosen for the PNTs. The items were matched in frequency, length and neighborhood size across Word Type (cognate vs. noncognate). The results will be discussed first for the L1 Croatian group, and then for the L1 Spanish and L1 German group.

For the L1 Croatian group, Table 20 shows factors that were controlled in both English and Croatian. English word information came from the same sources as in the previous two studies, however, for Croatian the frequencies per million were taken from a Croatian web corpus (hrWaC), and the neighborhood size was calculated by using *Korpus Savremenog Srpskog Jezika – SrpKor* (Utvić, 2013). Unfortunately, many of the factors were very difficult to control, which left the experiments with many significant differences. The problems mostly arose with English words where all the Croatian-English cognates were very long (e.g., *microphone*, *microscope*) and noncognates short. Neighborhood size and frequency seemed to be an issue in English, and word length in Croatian. These matters will be discussed in the following paragraphs with items that match in all of the mentioned factors.

Table 20. Means (and *SD*) and results of one-way ANOVAs for Word Type across factors like length, frequency and neighborhood size in English and Croatian

	Cognates	Noncognates	ANOVA
Length (ENG)	6.31 (1.82)	4.56 (0.89)	F (1, 30) = 4.67, p = **.002**
Frequency (ENG)	4.13 (0.45)	4.59 (0.55)	F (1, 30) = 0.13, p = **.02**
Neighborhood size (ENG)	3 (4.35)	12 (9.12)	F (1, 30) = 3.71, p < **.001**
Length (CRO)	5.88 (1.26)	4.56 (1.46)	F (1, 30) = 0.54, p = **.02**
Frequency (CRO)	34.72 (49.98)	87.08 (132.7)	F (1, 30) = 6.77, p = .24
Neighborhood size (CRO)	4.5 (3.68)	6.31 (6.09)	F (1, 30) = 7.08, p = .86

Word spelling difference between cognates and noncognates was calculated using Van Orden's measure of spelling similarity. Because the Shapiro Wilk test of normality showed non-normal distribution, a non-parametric test was used. The results of a Mann Whitney U test showed that there was a significant difference between the two Word Types (U = 135, p < **.001**). The difference in congruency was not significant (U = 84.50, p = .49).

Since the items in the PNT for Croatians did not match, another list was made with 18 experimental items (9 cognates and 9 noncognates) that matched in length, frequency and neighborhood size. An additional one-way ANOVA was run in order to test if cognates and noncognates are statistically different in terms of spelling similarity, and the spelling difference ended up being significant (*F* (1, 16) = 127.4, *p* < **.001**). Table 21 shows the list of factors English-Croatian cognates and noncognates were matched on, and the mean and the standard deviation of all factors according to Word Type.

Table 21. Means (and *SD*) and results of one-way ANOVAs for Word Type across factors like length, frequency and neighborhood size in English and Croatian (matched words)

	Cognates	Noncognates	ANOVA
Length (Eng)	5.11 (0.78)	5.11 (0.6)	*F* (1, 16) = .87, *p* = .36
Frequency (Eng)	4.35 (0.38)	4.61 (0.62)	*F* (1, 16) = 0.7, *p* = .41
Neighborhood size (Eng)	4.77 (5.19)	7.22 (3.38)	*F* (1, 16) = 1.51, *p* = .25
Length (Cro)	5.22 (0.67)	4.78 (1.2)	*F* (1, 16) = 2.17, *p* = .35
Frequency (Cro)	53.34 (61.21)	73.2 (135.8)	*F* (1, 16) = 0.64, *p* = .99
Neighborhood size (Cro)	3.56 (1.67)	8.78 (7.23)	*F* (1, 16) = 22.37, *p* = .16

The task had 32 experimental items and 32 fillers. Frequencies for Spanish were taken from a SUBTLEX-Esp (Cuetos et al., 2011) and neighborhood size from Spanish CLEARPOND (Marian et al., 2012). Words in both L1 and L2 were matched for length, frequency and neighborhood size (Table 22). A Mann Whitney U test showed significant difference between cognates and noncognates in terms of spelling similarity (*U* = 256, *p* < **.001**, *r* = 1).

Table 22. Means (and *SD*) and results of one-way ANOVAs for Word Type across factors like length, frequency and neighborhood size in English and Spanish

	Cognates	Noncognates	ANOVA
Length (ENG)	6.13 (1.71)	5.31 (1.25)	*F* (1, 30) = 1.22, *p* = .14
Frequency (ENG)	4.37 (0.44)	4.46 (0.44)	*F* (1, 30) = 0.002, *p* = .58
Neighborhood size (ENG)	4.69 (7.34)	5.25 (4.85)	*F* (1, 30) = 0.8, *p* = .26
Length (SPA)	6.06 (2.02)	5.94 (1.88)	*F* (1, 30) = 0.12, *p* = .86
Frequency (SPA)	3.1 (0.61)	2.85 (0.55)	*F* (1, 30) = 0.05, *p* = 24
Neighborhood size (SPA)	3.25 (3.89)	2.63 (2.80)	*F* (1, 30) = 0.2, *p* = .53

For the German PNT, frequencies for both English and German words were taken from a SUBTLEX-UK and SUBTLEX-DE database (Brysbaert et al., 2011; Van Heuven et al., 2014), and neighborhood size from CLEARPOND (Marian et al., 2012). A one-way ANOVA showed no significant difference between cognates and noncognates when it came to length, frequency and neighborhood size Table 23, except for marginal difference in frequency of German words.

Table 23. Means (and *SD*) and results of one-way ANOVAs for Word Type across factors like length, frequency and neighborhood size in English and German

	Cognates	Noncognates	ANOVA
Length (ENG)	5.25 (0.96)	5.25 (1.14)	F (1, 23) = 0.027, p = .87
Frequency (ENG)	4.38 (0.50)	4.16 (0.41)	F (1, 23) = 0.536, p = .47
Neighborhood size (ENG)	6.50 (6.78)	7.17 (6.22)	F (1, 23) = 1.051, p = .32
Length (GER)	5.50 (0.90)	5.50 (1.00)	F (1, 23) = 0.001, p = .99
Frequency (GER)	2.18 (0.58)	2.40 (0.24)	F (1, 23) = 9.404, p = **.06**
Neighborhood size (GER)	2.08 (2.78)	3.00 (2.17)	F (1, 22) = 0.874, p = .36

The LDT used the same experimental items as the PNT in L1 Croatian, L1 Spanish and L1 German groups. Croatian and Spanish LDTs had 32 and German 24 experimental items (Appendix A: I). Fillers items were added in order to not reveal the purpose of the experiment. The same number of filler words as the experimental words was used for each experiment. Half of the words were pseudo-words that look like English/German possible words, and half were non-words which are made out of illicit sound combinations in a target language.

2.4.4. Procedure.

2.4.4.1. Main experiment.

For all tests, the procedure was identical to the one in Experiment 1.

2.4.4.2. Control experiments.

The pictures for L1 German, L1 Croatian and L1 Spanish groups in the PNT were tested on naming consistency. Twenty native speakers of the respective languages were required to name the object on the paper. The naming consistency test was administered online for L1 Croatian and L1 Spanish speakers, and in person to L1 German speakers. If an object was named consistently 75% of the time, it was chosen for the experiment. The English PNT required naming objects by only using the appropriate noun. However, for the PNT in Spanish and German the use of both the definite article and the noun was required (Spanish: *la lampara*$_{\text{FEM}}$; German: *die Lampe*$_{\text{FEM}}$). In the Croatian PNT a demonstrative pronoun 'that' was used along with the noun (*ta lampa*$_{\mathrm{FEM}}$). The number of experimental items in the three L1s was the following: Croatian (n = 32), Spanish (n = 32) and German (n = 24).

2.4.5. Results.

2.4.5.1. Lexical decision task.

2.4.5.1.1. L1 Croatian group.

Reaction times below 200 ms and above 1500 ms were excluded from the analysis (1.3%). Only words that were answered correctly were taken into account. For the L1 Croatian group this means that 0.97% of the data was excluded. Word accuracy results of the generalized linear model for the L1 Croatian group (Table 24) show that the accuracy of the L1 Croatian group did not differ in Word Type (β = -1.13, SE = 0.76, z = -1.49, p = .14), Language (β = -0.70, SE = 0.71, z = -0.98, p = .33) or Word Type*Language (β = 1.22, SE = 0.88, z = 1.38, p = .17).

Table 24. The LDT word accuracy in percentage (and *SD*) in English and Croatian (n = 41)

	Cognates	Noncognates
English	100% (7%)	98% (12%)
Croatian	99% (10%)	99% (10%)

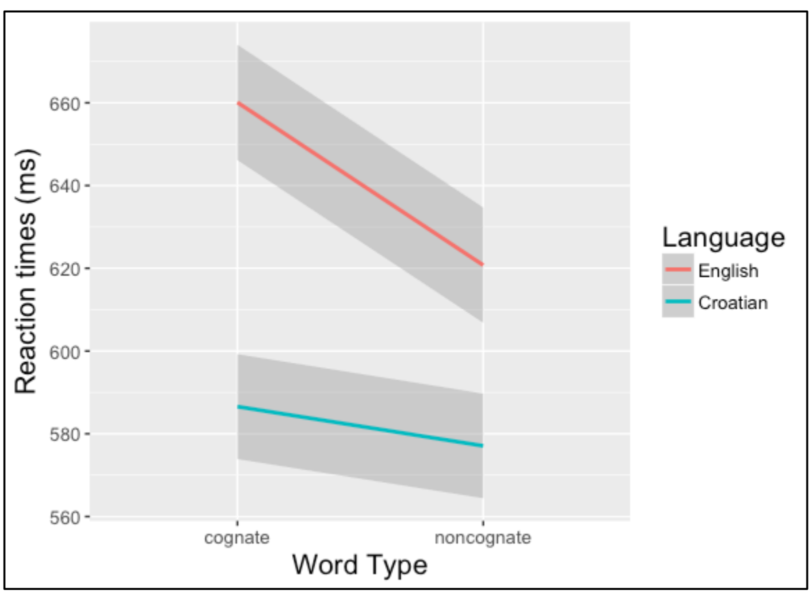

Figure 19. The LDT reaction times (in ms) for L1 Croatian and L2 English by Word Type (n = 41)

In Figure 19, the RTs show a slight advantage for noncognates (M = 577, SD = 163) than cognates (M = 586, SD = 161) in L1 Croatian and a bigger advantage for noncognates (M = 620, SD = 163) than cognates (M = 660, SD = 193) in the L2 English. Moreover, L1 Croatian learners were faster in their L1. A generalized linear model found significant main effects of Word Type (β = -42.40, SE = 15.09, t = -2.81, p = **.008**) and Language (β = -75.21, SE = 8.27, t = -9.10, p < **.001**), and a significant interaction of Word Type and Language (β = 32.26, SE = 11.69, t = 2.76, p = **.006**). This time around, the main effect of Word Type displayed a reversed picture—faster RTs for noncognates rather than cognates. The main effect of Language displayed the same picture as in previous LDTs, i.e. faster responses in the L1. The interaction showed a higher effect in participants' L2. These results were not as expected, and for this reason a sub-list of existing words was compiled, with factors that matched in both cognate and noncognate conditions.

The accuracy of matched words displays was at ceiling (Table 25), similarly to the unmatched words. The results of the model showed no significant effect of Word Type (β = -0.41, SE = 0.92, z = -0.45, p = .65) and Language (β = 0.70, SE = 1.23, z = 0.57, p = .57), or the Word Type by Language interaction (β = -0.70, SE = 1.48, z = -0.47, p = .64).

Table 25. The LDT word accuracy in percentage (and *SD*) of matched words in English and Croatian (n = 41)

	Cognates	Noncognates
English	99% (7%)	99% (9%)
Croatian	100% (5%)	99% (9%)

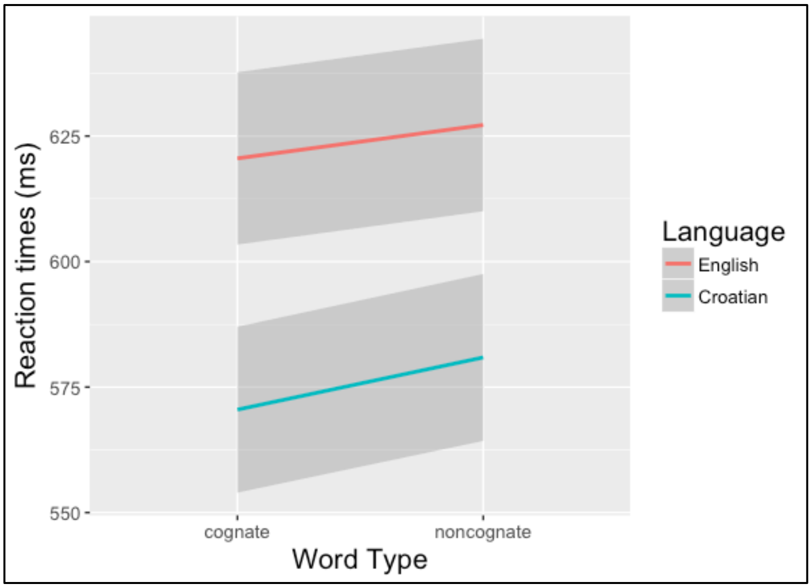

Figure 20. LDT reaction times (in ms) for L1 Croatian and L2 English by Word Type for matched words (*n* = 41)

Figure 20 shows slight differences between RTs for cognates (English: $M = 620$, $SD = 161$; Croatian: $M = 570$, $SD = 145$) and noncognates (English: $M = 627$, $SD = 170$; Croatian: $M = 580$, $SD = 175$) in both tasks, but the model found only a main effect of Language ($\beta = -51.15$, $SE = 10.52$, $t = -4.86$ $p <$ **.001**). The results of Word Type ($\beta = 6.02$, $SE = 15.86$, $t = 0.38$, $p = .71$) and the interaction of Word Type and Language ($\beta = 14.91$, $SE = 14.91$, $t = 0.28$, $p = .70$) were not significant. This means that even after matching the words, no cognate facilitation effect was observed during word comprehension in L1 and L2.

2.4.5.1.2. L1 Spanish group.

For the L1 Spanish group, the cutoff points for RTs excluded 1.82% of the data, and also 1.99% of data that were answered inaccurately by L1 Spanish learners. The L1 Spanish group scored high on accuracy for both English and Spanish (Table 26). However, in English, the accuracy for L1 words was higher than L2 words ($\beta = 1.94$, $SE = 0.71$, $z = 2.73$, $p =$ **.006**). Word Type and Language interaction ($\beta = -1.78$, $SE = 0.89$, $z = -2.01$, $p =$ **.04**) also revealed a significant difference, seen in higher accuracy for cognates in Spanish than for cognates in English. Word Type ($\beta = 0.10$, $SE = 0.78$, $z = 0.13$, $p = .89$) did not affect the results.

Table 26. The LDT word accuracy in percentage (and *SD*) in English and Spanish (*n* = 25)

	Cognates	Noncognates
English	97% (18%)	98% (14%)
Spanish	99% (9%)	98% (13%)

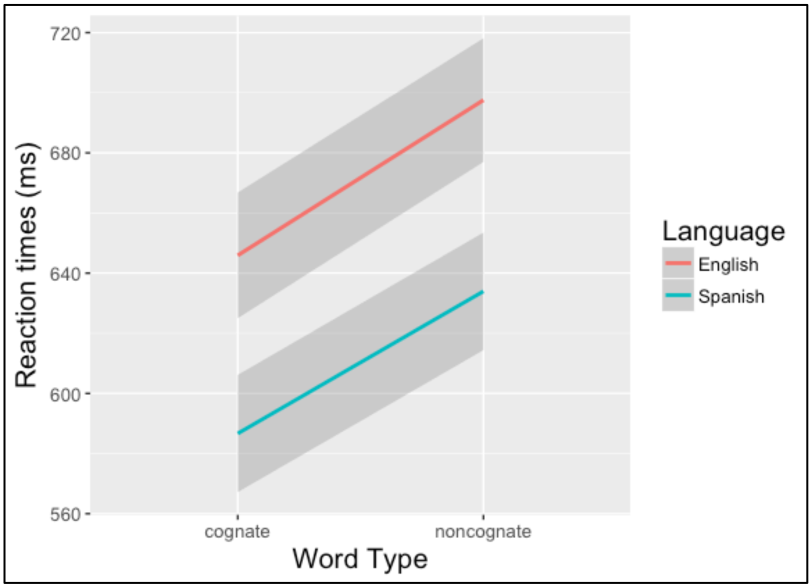

Figure 21. The LDT reaction times (in ms) for L1 Spanish and L2 English by Word Type (*n* = 25)

Figure 21 shows the RTs for cognates and noncognates in L1 Spanish (cognates: M = 586, SD = 174; noncognates: M = 633, SD = 209) and L2 English (cognates: M = 645, SD = 185; noncognates: M = 697, SD = 215). The RTs for cognates in both LDTs are shorter than for noncognates. The model shows a main effect of Language (β = -63.22, SE = 12.55, t = -5.04, p < **.001**), and a marginally significant effect of Word Type (β = 47.14, SE = 22.84, t = 2.06, p = **.05**). The interaction of Word Type and Language was not significant (β = 0.43, SE = 17.63, t = 0.03, p = .98). The main effect of Language shows faster RTs in participants' L2 and the main effect of Word Type replicates cognate facilitation effect in L1 Spanish and L2 English.

2.4.5.1.3. L1 German group.

As for the L1 German group, after eliminating RTs which were outside of the cutoff points (0.63%) and items that were answered incorrectly (1.00%), the accuracy rates among L1

German learners of L2 English could be seen in Table 27. Even though the accuracy for noncognates was slightly lower in L2 English, the model revealed no effect of Word Type (β = -1.28, *SE* = 0.81, *z* = -1.58, *p* = .11). Language (β = 17.44, *SE* = 114.49, *z* = 0.15, *p* = .89) and a Word by Language interaction (β = -16.17, *SE* = 114.49, *z* = -0.14, *p* = .89) also did not show any effect on the results.

Table 27. The LDT word accuracy in percentage (and *SD*) in English and German (*n* = 24)

	Cognates	Noncognates
English	99% (9%)	97% (16%)
German	100% (0%)	99% (9%)

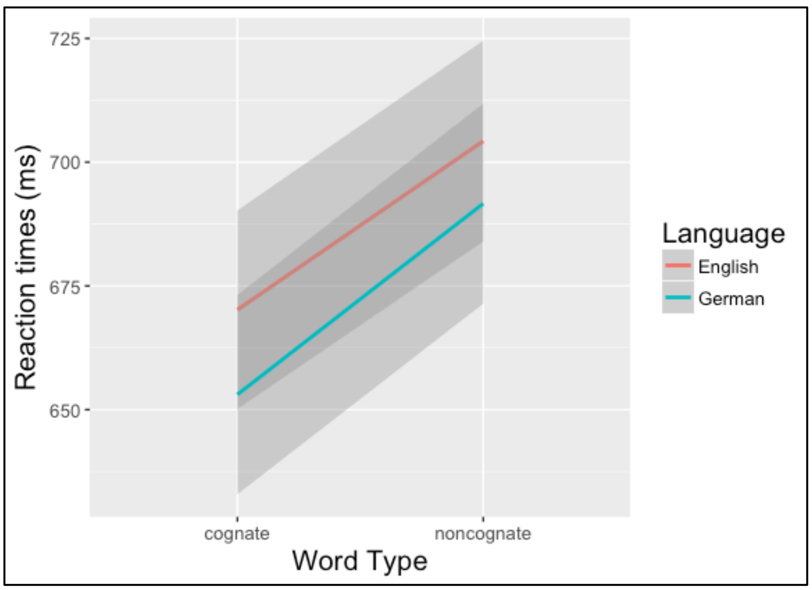

Figure 22. The LDT reaction times (in ms) for L1 German and L2 English by Word Type (*n* = 24)

Figure 22 shows that L1 German learners read cognates faster than noncognates in their L1 (cognates: *M* = 653, *SD* = 159; noncognates: *M* = 691, *SD* = 179) and L2 (cognates: *M* = 670, *SD* = 171; noncognates: *M* = 704, *SD* = 165). A linear mixed effects model was run for RTs in L1 German and L2 English LDTs, and it showed a marginally significant main effect of Word Type (β = 33.65, *SE* = 17.35, *t* = 1.94, *p* = **.06**). A Language and Word Type interaction (β = -17.50, *SE* = 13.14, *t* = -1.33, *p* = .18) and a main effect Language (β = 4.95, *SE* = 18.65, *t* = 0.27, *p* = .79) did not affect the results. As illustrated in Figure 22, the main effect of

Word Type shows cognate facilitation effects, i.e. cognates being processed much faster. The L1 German group read the L1 and L2 items at a similar pace.

To sum up, the L1 German and L1 Spanish group showed a clear cognate facilitation effect during word recognition by having faster RTs for cognates than for noncognates in both L1 and L2. The L1 Croatian group showed a main effect of Word Type, but in the opposite direction, i.e. longer RTs for cognates and shorter RTs for noncognates. After choosing only words that match in frequency, length and neighborhood size, the effect was still not present, even though the RTs show a trend towards a cognate facilitation effect. The following section deals with cognate facilitation effect in word production by employing a PNT.

2.4.5.2. Picture naming task.

2.4.5.2.1. L1 Croatian group.

Thirty-two items were used in the PNTs for L1 Croatian L2 English learners, the same ones as in the corresponding LDT. By using the cutoff point for the RTs, 8.8% of the data ended up being excluded. Table 28 shows that the accuracy of naming items was higher in L1 Croatian than in L2 English. This was confirmed by a generalized mixed effects model showing a highly significant main effect of Language ($\beta = 0.69$, $SE = 0.21$, $z = -3.27$, $p <$ **.001**). The effects of Word Type ($\beta = -0.20$, $SE = 0.31$, $z = -0.63$, $p = .52$) and Word Type by Language ($\beta = 0.15$, $SE = 0.29$, $z = 0.51$, $p = .61$) were not significant.

Table 28. The PNT word accuracy in percentage (and *SD*) in English and Croatian ($n = 41$)

	Cognates	Noncognates
English	89% (31%)	87% (33%)
Croatian	94% (23%)	94% (24%)

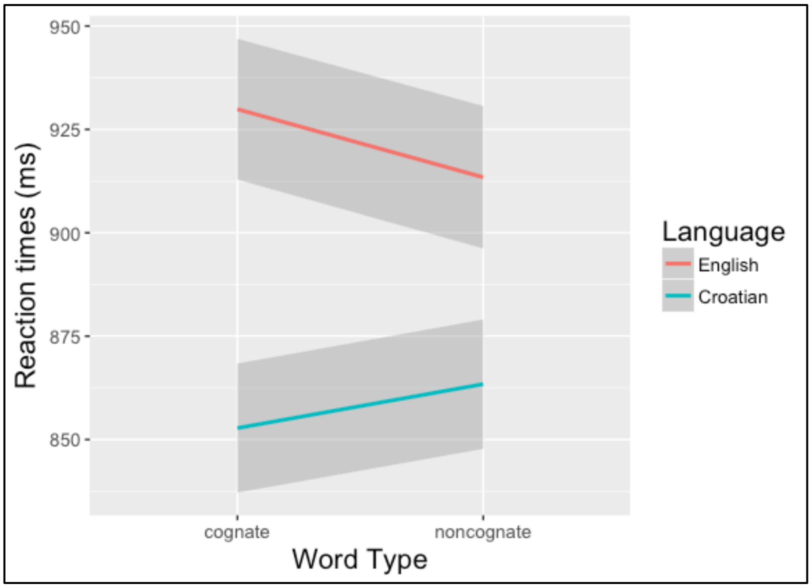

Figure 23. The PNT reaction times (in ms) for L1 Croatian and L2 English by Word Type (n = 41)

Figure 23 shows slight differences between cognates and noncognate which go in opposite directions for L1 Croatian and L2 English. In L1 Croatian, learners named cognates (M = 852, SD = 187) faster than noncognates (M = 863, SD = 206), and in L2 English noncognates (M = 914, SD = 212) were named faster than cognates (M = 931, SD = 187). A linear mixed effects model showed no effect of Word Type (β = -14.86, SE = 27.77, t = -0.54, p = .60) nor a Word Type and Language interaction (β = 23.23, SE = 14.47, t = 1.61, p = .11). However, a highly significant main effect of Language (β = -77.72, SE = 10.2, t = -7.62, p < **.001**) was detected, shown in longer RTs for L2 English items. Yet, one big drawback of the items for the L1 Croatian group is the fact that they are not matched on all factors. The next paragraph looks at the PNT results for matched items.

Words that matched according to length, frequency and neighborhood size were 18 words in total (9 cognates and 9 noncognates). Table 29 shows the results of accuracy, displaying higher accuracy scores for the L1 than the L2. A generalized mixed effects model did not find Word Type (β = -0.11, SE = 0.43, z = -0.26, p = .79) nor Word Type by Language (β = 0.37, SE = 0.41, z = 0.91, p = .36) to have an effect on the accuracy results. However, Language (β = 0.56, SE = 0.28, z = 2.01, p = **.04**) affected the results which could be seen in higher accuracy for L1 Croatian items.

Table 29. The PNT word accuracy in percentage (and *SD*) for matched words in English and Croatian (*n* = 41)

	Cognates	Noncognates
English	90% (30%)	89% (31%)
Croatian	94% (24%)	95% (21%)

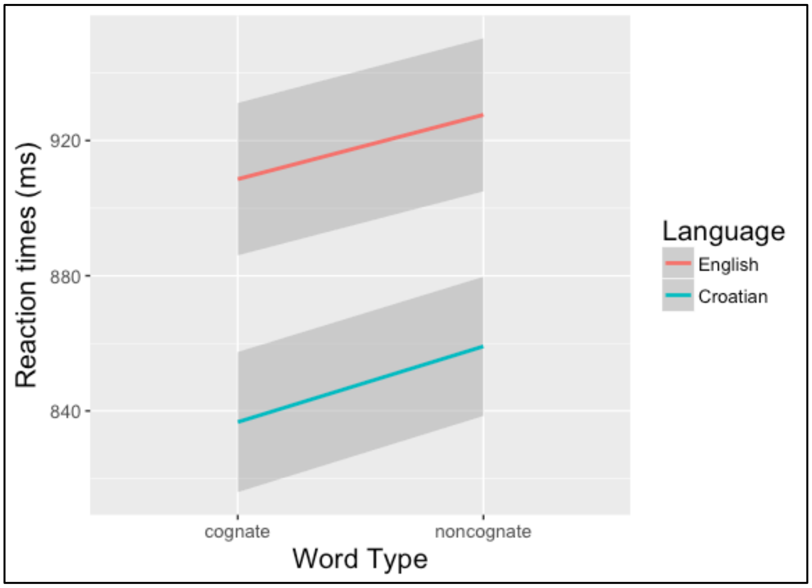

Figure 24. The PNT reaction times (in ms) for matched words in L1 Croatian and L2 English by Word Type ($n = 41$)

The mean RTs for items in L1 Croatian and L2 English can be seen in Figure 24. In L1 Croatian cognates ($M = 836$, $SD = 180$) were named faster than noncognates ($M = 859$, $SD = 211$), which was the same for cognates ($M = 908$, $SD = 203$) and noncognates ($M = 927$, $SD = 214$) in L2 English. Similarly to the accuracy results, the model reveals no effect of Word Type ($\beta = 19.37$, $SE = 36.47$, $t = 0.53$, $p = .60$) and Word Type by Language ($\beta = -1.67$, $SE = 19.39$, $t = -0.09$, $p = .93$), but a main effect of Language ($\beta = -69.92$, $SE = 13.72$, $t = -5.10$, $p <$ **.001**). The effect of Language is seen in longer RTs for L2 English than L1 Croatian. Therefore, the cognate facilitation effect was also not found for the matched items.

2.4.5.2.2. L1 Spanish group.

Quite similarly to the L1 Croatian group, 32 items were used in the case of PNTs for English-Spanish bilinguals. The same items were used as in participants' LDT, with the only difference of using pictures of objects to represent them. After looking at the RTs, 11.46% of the data was eliminated. Table 30 presents the naming accuracy which was higher with cognates in the English PNT. This was also supported by results of the model, showing a marginally significant interaction of Word Type and Language ($\beta = 0.83$, $SE = 0.46$, $z = 1.83$, $p = \mathbf{.07}$). There was also an effect of Word Type ($\beta = -1.43$, $SE = 0.37$, $z = -3.87$, $p < \mathbf{.001}$) and Language ($\beta = 1.59$, $SE = 0.36$, $z = 4.42$, $p < \mathbf{.001}$) shown in lower accuracy for noncognates in both languages and in lower accuracy for all items in L1 English.

Table 30. The PNT word accuracy in percentage (and *SD*) in English and Spanish (*n* = 25)

	Cognates	Noncognates
English	90% (31%)	72% (45%)
Spanish	97% (16%)	96% (21%)

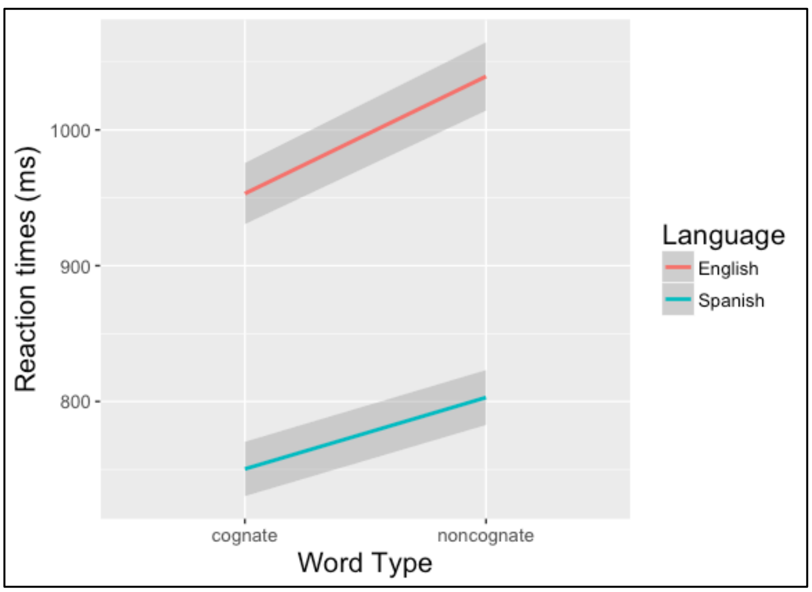

Figure 25. The PNT reaction times (in ms) for L1 Spanish and L2 English by Word Type (*n* = 25)

Figure 25 shows that L1 Spanish learners took longer to name words in their L2 English than in their L1, and it shows a slight advantage in naming cognates in L1 (cognates: $M = 750$, $SD = 182$; noncognates: $M = 802$, $SD = 210$) and L2 (cognates: $M = 953$, $SD = 202$; noncognates: $M = 1039$, $SD = 222$), especially in L2 English. The model reveals main effects of Word Type ($\beta = 86.84$, $SE = 21.98$, $t = 3.95$, $p < \mathbf{.001}$) and Language ($\beta = -210.61$, $SE = 13.27$, $t = -15.87$, $p < \mathbf{.001}$), as well as a marginally significant interaction of Word Type and

Language (β = -33.98, *SE* = 19.46, *t* = -1.75, *p* = **.08**). The results support the graph by showing significant differences in naming RTs between items in L1 and L2. Moreover, cognates are named faster than noncognates, and the interaction shows that this is especially visible in L2 English.

2.4.5.2.3. L1 German group.

Data selection based on RTs cutoff points excluded 12.68% of the overall L1 German data. According to the word naming accuracy (Table 31), German native speakers struggled with naming noncognates. Only 69% of the time did they know the name of the noun in English as opposed to nouns that are cognates (*M* = 89%, *SD* = 31%). However, a Word Type by Language interaction (β = 0.46, *SE* = 0.51, *z* = 0.89, *p* = .37) was not detected, but a main effect of Word Type (β = -1.53, *SE* = 0.41, *z* = -3.71, *p* < **.001**). A main effect of Language (β = 1.62, *SE* = 0.42, *z* = 3.82, *p* < **.001**) showed that L1 German learners were better at naming items in their L1.

Table 31. The PNT word accuracy in percentage (and *SD*) in English and German (*n* = 24)

	Cognates	Noncognates
English	89% (31%)	69% (46%)
German	97% (16%)	94% (24%)

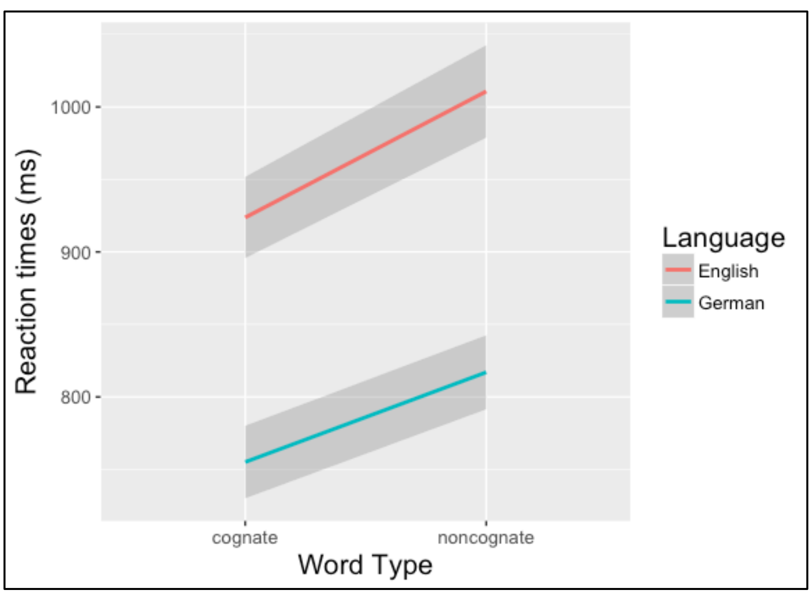

Figure 26. The PNT reaction times (in ms) for L1 German and L2 English by Word Type (*n* = 24)

Figure 26 shows that L1 German learners took longer to name words in L2 English. There also seems to be a facilitation effect for cognates in learners' L1 (cognates: M = 755, SD = 182; noncognates: M = 817, SD = 231) and L2 (cognates: M = 923, SD = 221; noncognates: M = 1010, SD = 224). The model reveals main effects of Word Type (β = 94.31, SE = 34.48, t = 2.74, p = **.01**) and Language (β = -172.5, SE = 16.69, t = -10.34, p < **.001**). There was no interaction of Word Type by Language (β = -29.18, SE = 24.7, t = -1.18, p = .24). This means that, quite similarly to the LDT task, a cognate facilitation effect was detected in the PNT.

The results of the PNTs resemble the results of the LDT task. Cognate facilitation effects were visible for the L1 German and L1 Spanish group. In the case of the L1 Croatian, there was no effect of Word Type for both mismatched and matched items. However, in the PNT with match items, there seems to be a trend towards shorter RTs for cognates that is approaching significance. The results of the LDT and the PNT show that the cognate facilitation effect is visible in production and recognition with isolated words for L1 German and L1 Spanish, and could possibly be observed in a sentence context. The following section covers the eye-tracking results for L1 Croatian, L1 Spanish and L1 German learners of English.

2.4.5.3. Visual world paradigm.

In the current section, the results of three language mixing studies will be illustrated, namely, with L1 Croatian, L1 Spanish and L1 German L2 English learners. As in the previous eye-tracking experiment, generalized mixed effects models were used. The proportion of fixations for cognates and noncognates was analyzed with Word Type, Congruency and Trial as fixed effects (including their interactions). Furthermore, for random effects, random intercepts were used for Participant and Item, and by-participant and by-item random slopes for Congruency. As in Experiment 1, experimental items were grouped according to four conditions: cognate match, cognate mismatch, noncognate match and noncognate mismatch. The analysis looked at two time windows: (i) from -300 ms before the pronoun until 200 ms after the pronoun, and (ii) 200-700 ms after the pronoun.

2.4.5.3.1. L1 Croatian group.

The language mixing experiment with the L1 Croatian group used 32 experimental items in the same four conditions as in Experiment 1 (i.e., cognate match, cognate mismatch, noncognate match and noncognate mismatch). The same generalized mixed effect model was run first on the two time windows (i.e., TW1 and TW2), and then also specifically on the first and the second half of the experiment if there were significant interactions with Trial.

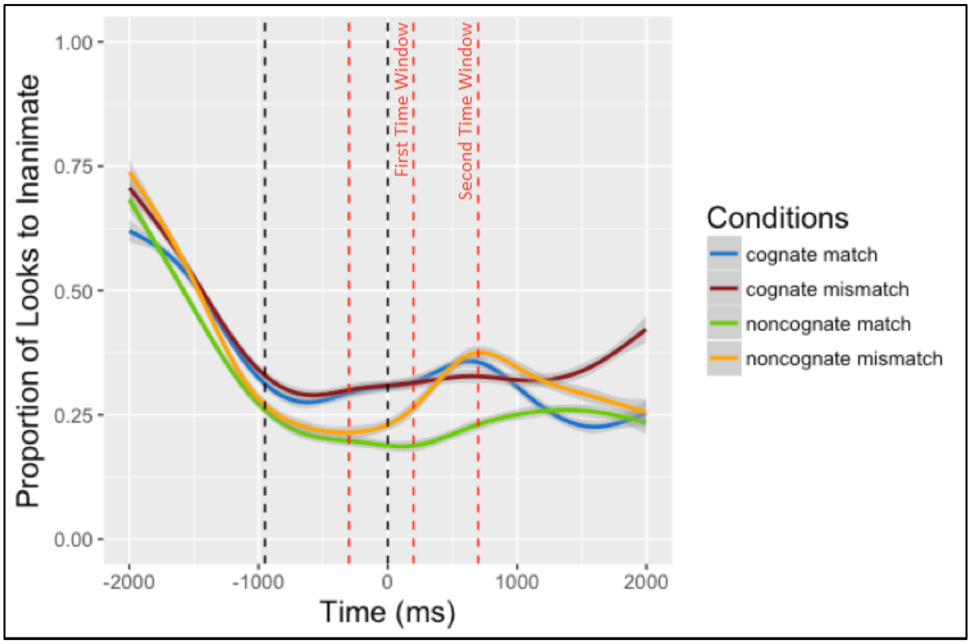

Figure 27. L1 Croatian: Fixation proportions to the inanimate object in four conditions (i.e., cognate match, cognate mismatch, noncognate match and noncognate mismatch) during the visual world paradigm (n = 41). The timeline of the experiment is shown in milliseconds; 0 represents the onset of the pronoun. The first black dotted line shows the ending of the first sentence, the second black dotted line represents the onset of the pronoun, and the red dotted lines label two time windows that were analyzed.

Figure 27 does not show differences in the number of fixations to the object for cognates that match and mismatch in gender in TW1 nor TW2. As for noncognates, the inanimate object is fixated more in the incongruent (mismatched) condition, which could be seen when the match and mismatch condition start diverging around 200 ms before the onset of the pronoun. The effect extended even beyond TW2. The model found a main effect of Word Type and Trial. The effect of Word Type is shown in a higher proportion of looks towards the inanimate object for cognates compared to noncognates (Table 32). There were also three interactions found: Congruency and Trial; Word Type and Trial; and Congruency, Word Type and Trial. The interaction of Congruency and Word Type was not significant.

Table 32. The output from the generalized linear-mixed effects models run on TW1 for L1 Croatian group (*n* = 41). The fixed factors included: Congruency (match vs. mismatch), Word Type (cognate vs. noncognate) and Trial.

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-0.95	0.21	-4.42	< .001
Congruency	-0.05	0.37	-0.14	.89
WordType	-0.82	0.26	-3.13	**.002**
Trial	0.48	0.04	13.37	**.001**
Congruency*WordType	0.10	0.43	0.22	.83
Congruency*Trial	-0.43	0.05	-8.04	**.001**
WordType*Trial	-0.74	0.05	-14.88	**.001**
Congruency*WordType*Trial	0.81	0.07	10.87	**.001**

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

Table 33 lists the findings of the model on TW2. Word Type and Trial had a highly significant effect on the fixation proportion to the object. Again, Word Type advocates for a higher proportion of looks for cognates, regardless of the condition. There was also an interaction of Congruency and Word Type, but it was shown in lower fixation proportions for noncognates that match in gender with the pronoun compared to nouns that mismatch. Two more interactions were recorded: Word Type and Trial; and Congruency, Word and Type. The three-way interaction shows that Trial influenced the results of fixation proportion.

Table 33. The output from the generalized linear-mixed effects models run on TW2 for L1 Croatian group (n = 41).

	Estimate	SE	z-value	p-value
(Intercept)	-0.69	0.21	-3.28	< .001
Congruency	-0.46	0.42	-1.11	.27
WordType	-1.49	0.35	-4.30	**.001**
Trial	0.34	0.04	9.07	**.001**
Congruency*WordType	1.50	0.61	2.47	**.01**
Congruency*Trial	-0.09	0.06	-1.65	.10
WordType*Trial	-0.37	0.05	-7.07	**.001**
Congruency*WordType*Trial	0.52	0.08	6.64	**.001**

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

Because the model for TW2 showed a Congruency by Word Type interaction, the follow up analysis looked at cognates and noncognates separately. The same model was used, only without Word Type as a fixed factor because cognates and noncognates were analyzed separately. The analysis of TW1 found a main effect of Trial ($\beta = 0.46$, $SE = 0.03$, $z = 13.65$, $p <$ **.001**) and an interaction of Congruency and Trial for cognates ($\beta = -0.40$, $SE = 0.05$, $z = -7.91$, $p <$ **.001**). The noncognate analysis also showed a main effect of Trial ($\beta = -0.31$, $SE = 0.04$, $z = -8.15$, $p <$ **.001**) and an interaction of Congruency and Trial ($\beta = 0.37$, $SE = 0.63$, $z = 6.59$, $p <$ **.001**). However, no main effect of Congruency was detected. In TW2, again, cognates displayed a main effect of Trial ($\beta = 0.31$, $SE = 0.03$, $z = 9.12$, $p <$ **.001**) and a marginally significant interaction of Congruency and Trial ($\beta = -0.09$, $SE = 0.05$, $z = -1.60$, $p =$ **.09**). Noncognates, on the other hand showed a main effect of Congruency ($\beta = 1.10$, $SE = 0.51$, $z = 2.13$, $p =$ **.03**) and an interaction of Congruency and Trial ($\beta = 0.46$, $SE = 0.06$, $z = 7.87$, $p <$ **.001**). A main effect of Congruency was seen in a higher fixation proportion for noncognates that mismatch in gender (see Appendix A: IV).

Therefore, the results do not support the prediction that a higher proportion of looks to inanimate objects in the congruent match condition would be observed. Even though we do not see a clear interaction between Word Type and Congruency, we can observe that Trial interacts with Word Type and Congruency. This means that, like in Experiment 1, a closer look at the two halves of the experiment might show us how the experiment develops through time and how the participants react at two different points of the experiment. The first half refers to the first part of the experiment, and the second half refers to the second part of the experiment.

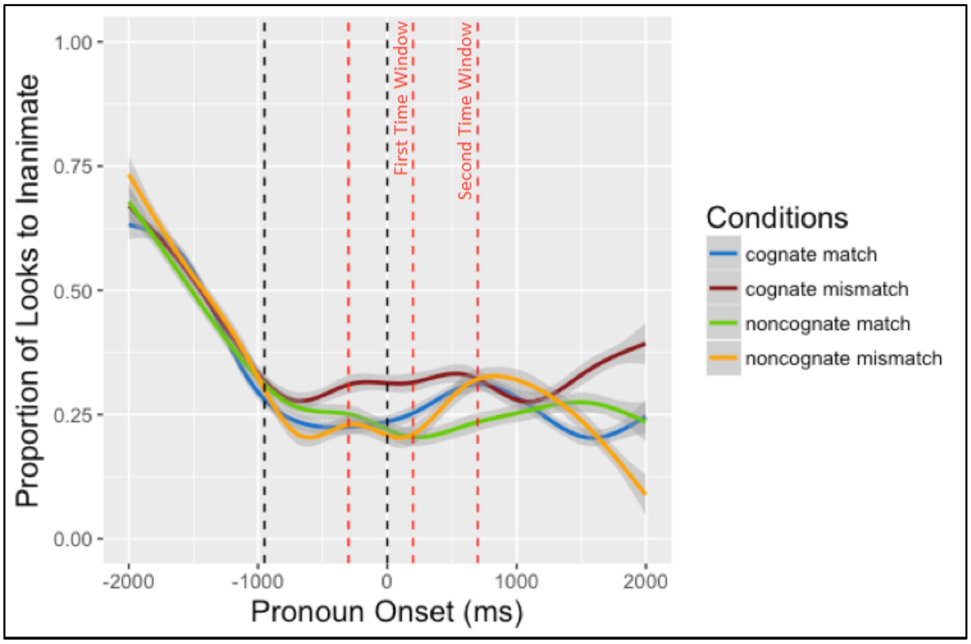

Figure 28. L1 Croatian: Fixation proportions to the inanimate object in four conditions of the first half during the visual world paradigm (n = 41)

In Figure 28, in the first half of the experiment there is a tendency for L2 learners to look at the incongruent cognates more than the congruent cognates in both time windows. As for noncognates, there seems to be a similar pattern, at least in TW2 where the object is fixated more when the gender of the inanimate object does not match the gender of the pronoun. Statistically, the analysis of the first half of TW1 showed a Congruency and Word Type interaction (Table 34).

Table 34. The output from the generalized linear-mixed effects models run on TW1 of the first half for the L1 Croatian group ($n = 41$).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.91	0.39	-4.89	< .001
Congruency	0.87	0.59	1.46	.15
WordType	0.28	0.47	0.60	.55
Congruency*WordType	-1.63	0.72	-2.28	**.02**

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

The analysis on TW2 returned a main effect of Word Type (Table 35). The main effect is seen in a higher proportion of looks towards the object in the case of cognates. An interaction of Congruency and Word Type was not detected.

Table 35. The output from the generalized linear-mixed effects models run on TW2 of the first half for the L1 Croatian group ($n = 41$).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.68	0.58	-2.90	.004
Congruency	-0.30	0.92	-0.33	.74
WordType	-2.11	1.02	-2.06	**.04**
Congruency*WordType	1.97	1.41	1.40	.16

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

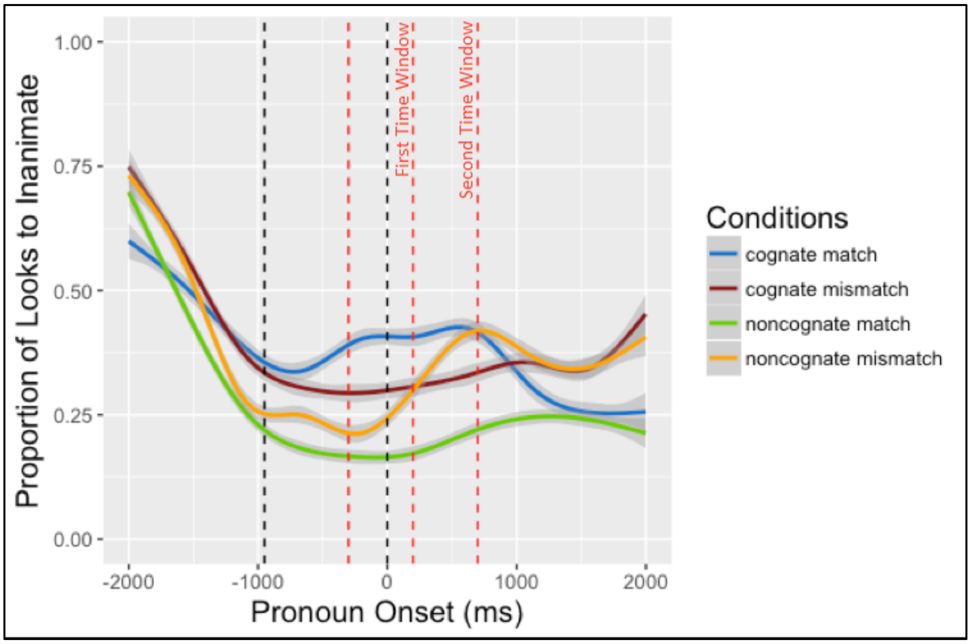

Figure 29. L1 Croatian: Fixation proportions to the inanimate object in four conditions of the second half during the visual world paradigm (*n* = 41)

Figure 29 illustrates the proportion of looks in the second half of the experiment. It shows a different picture than the first half of the experiment, as the higher proportion of looks to congruent cognates than incongruent cognates was visible a bit after the offset of the first sentence. As for noncognates, the incongruent condition yielded more fixations than the congruent condition in both time windows. The model showed a highly significant main effect of Word Type, seen in more fixations towards the object for cognates than noncognates (Table 36). An interaction of Congruency and Word Type was also detected, which was marginally significant for cognates, i.e. a higher number of fixations towards cognates that match in gender than those that mismatch (β = -1.42, *SE* = 0.78, z = -1.82, p = **.07**).

Table 36. The output from the generalized linear-mixed effects models run on TW1 of the second half for the L1 Croatian group (n = 41).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-0.54	0.50	-1.07	.29
Congruency	-1.40	0.81	-1.74	.08
WordType	-3.31	0.87	-3.83	**.001**
Congruency*WordType	2.87	1.15	2.50	**.01**

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

The results of TW2 show a marginally significant effect of Congruency and a highly significant effect of Word Type (Table 37). The effect of Word Type shows higher proportions of looks for cognates. An interaction of Congruency and Word Type was also detected. Because in both first and second half there was an interaction of Congruency and Word Type, the data was split according to Word Type, and cognates were analyzed separately from noncognates.

Table 37. The output from the generalized linear-mixed effects models run on TW2 of the second half for the L1 Croatian group (n = 41).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-0.10	0.50	-0.19	.85
Congruency	-1.53	0.84	-1.82	**.07**
WordType	-3.31	0.92	-3.60	**.001**
Congruency*WordType	4.09	1.23	3.34	**.001**

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

The analysis on TW1 of the first half found a marginally significant Congruency effect only for cognates ($\beta = 1.24$, $SE = 0.65$, $z = 1.92$, $p =$ **.06**), yet, the effect was seen in more fixations for mismatched items. In TW2 of the first half, cognates nor noncognates found a significant effect of Congruency. However, TW1 of the second half recorded a marginally significant effect of Congruency for cognates (β = -1.42, *SE* = 0.78, *z* = -1.82, *p* = **.07**). No significant differences were found for noncognates. Finally, TW2 found a marginally significant effect for both cognates (β = -1.49, *SE* = 0.8, *z* = -1.87, *p* = **.06**) and a significant effect for noncognates (β = 2.73, *SE* = 1.13, *z* = 2.42, *p* = **.02**). For more information on the whole model, see Appendix A: IV.

Therefore, the L1 Croatian group showed a three-way interaction of Congruency, Word Type and Trial on both TW1 and TW2. The split according to the Trial showed an interaction of Congruency and Word Type for the first and the second half. TW1 of the first half only found an effect for cognates, but in the opposite direction, i.e. more fixations for the mismatch items. However, in TW1 and TW2 of the second half, a marginally significant interaction of Congruency and Word Type was found for cognates, seen in more looks when the items match in gender with the pronoun.

2.4.5.3.2. L1 Spanish group.

Thirty-two items were with the same four conditions were used for the Spanish-English language mixing context (Figure 30). In the figure, no differences between the conditions could be observed in TW1 nor TW2 for cognates. As for noncognates, the lines between match and mismatch items start to diverge even around 1400 ms before the onset. The higher number of proportions for match noncognates is present in TW1 and TW2.

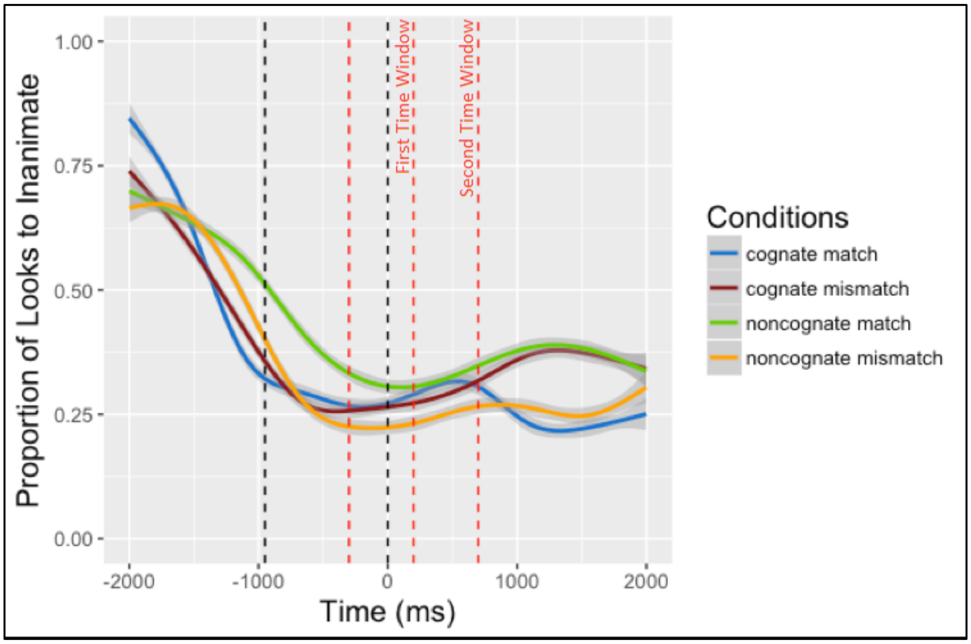

Figure 30. L1 Spanish: Fixation proportions to the inanimate object in four conditions (i.e., cognate match, cognate mismatch, noncognate match and noncognate mismatch) during the visual world paradigm (n = 25).

The model run on TW1 found a main effect of Type. A two-way interaction of Word Type and Trial and a three-way interaction of Congruency, Word Type and Trial were detected (Table 38).

Table 38. The output from the generalized linear-mixed effects models run on TW1 for L1 Spanish group (*n* = 25). The fixed factors included: Congruency (match vs. mismatch), Word Type (cognate vs. noncognate) and Trial.

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.62	0.45	-3.61	< .001
Congruency	-0.02	0.45	-0.05	.96
WordType	0.54	0.48	1.14	.26
Trial	-0.19	0.05	-3.72	**.001**
Congruency*WordType	-0.57	0.48	-1.18	.24
Congruency*Trial	0.02	0.07	0.31	.76
WordType*Trial	0.52	0.07	7.33	**.001**
Congruency*WordType*Trial	-0.38	0.10	-3.70	**.001**

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

The analysis of TW2 found a main effect of Trial and several interactions. Namely, there was an interaction of Congruency and Trial; Word Type and Trial; and Congruency, Word Type and Trial. Because there was no interaction of Congruency and Word Type for TW1 and TW2, further analyses on cognates and noncognates separately will not be done. However, because both time windows had a three-way interaction of Congruency, Word Type and Trial, the data will be split into two halves according to Trial.

Table 39. The output from the generalized linear-mixed effects models run on TW2 for L1 Spanish group (*n* = 25).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.12	0.33	-3.38	< .001
Congruency	-0.45	0.46	-0.98	.33
WordType	-0.20	0.55	-0.36	.72
Trial	-0.24	0.05	-4.55	**.001**
Congruency*WordType	0.34	0.74	0.46	.64
Congruency*Trial	0.18	0.07	2.42	**.02**
WordType*Trial	0.63	0.07	8.69	**.001**
Congruency*WordType*Trial	-0.50	0.10	-4.94	**.001**

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

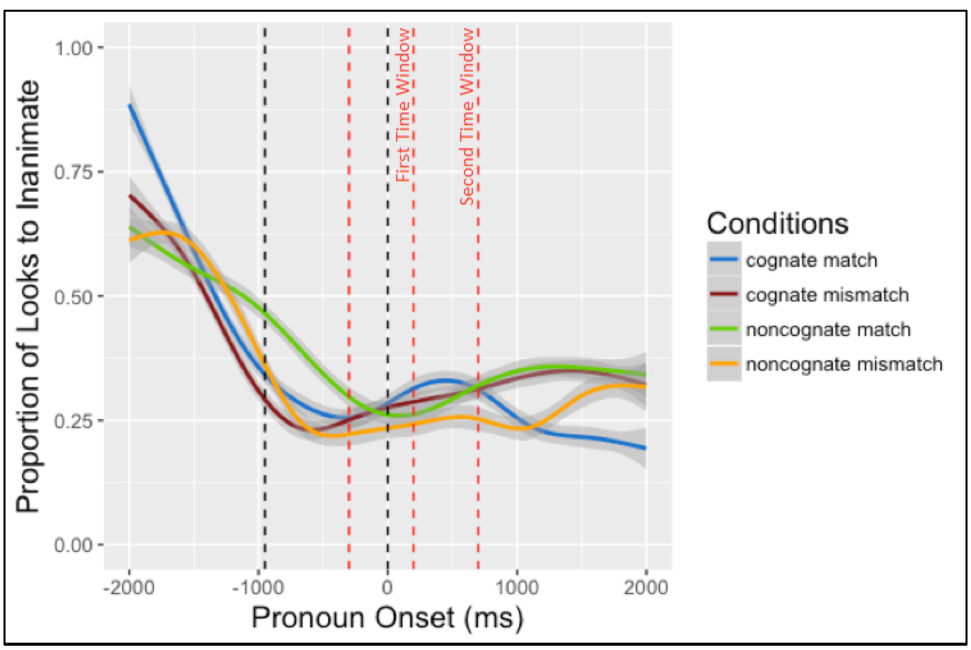

Figure 31. L1 Spanish: Fixation proportions to the inanimate object in four conditions of the first half during the visual world paradigm (*n* = 25)

Figure 31 displays the fixation proportions for the first half and Figure 32 for the second half of the experiment. In the first half, the fixations of conditions did not display any differences between congruent and incongruent conditions for cognates nor noncognates. In the second half, the congruent condition for noncognates yielded slightly higher number of fixations even before the first sentence ends. For the first half of the experiment, the model showed no Word Type and Congruency interaction in TW1 (Table 40) or in TW2 (Table 41).

Table 40. The output from the generalized linear-mixed effects models run on TW1 of the first half for the L1 Spanish group (*n* = 25).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-2.06	0.81	-2.55	.01
Congruency	-1.27	1.06	-1.20	.23
WordType	-0.75	1.05	-0.72	.47
Congruency*WordType	1.29	1.07	1.21	.23

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

Table 41. The output from the generalized linear-mixed effects models run on TW2 of the first half for the L1 Spanish group (*n* = 25).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-2.39	1.51	-1.58	.12
Congruency	0.29	1.76	0.17	.87
WordType	-1.62	2.22	-0.73	.47
Congruency*WordType	0.28	2.60	0.11	.91

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

The results are supported by a post hoc analysis of cognates and noncognates (Appendix A: IV). This means that no effects of congruency were found and, therefore, no L1 congruency effect from L1 Spanish into L2 English.

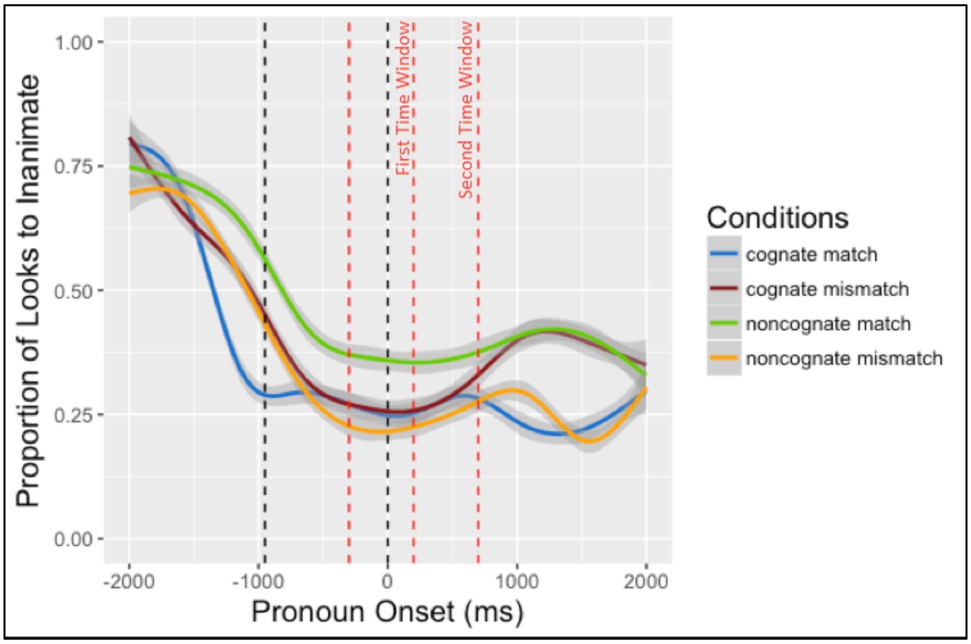

Figure 32. L1 Spanish: Fixation proportions to the inanimate object in four conditions of the second half during the visual world paradigm (n = 25).

Figure 32 shows no difference between conditions for cognates in TW1 and TW2. However, noncognates seem to have a higher difference of the proportion of looks between conditions, as match items yielded a higher proportions of looks in both time windows. Yet, statistically, there was no significant difference in TW1 of the second half (Table 42) nor TW2 of the second half (Table 43).

Table 42. The output from the generalized linear-mixed effects models run on TW1 of the second half for the L1 Spanish group (n = 25).

	Estimate	SE	z-value	p-value
(Intercept)	-2.97	1.20	-2.47	.01
Congruency	-1.14	1.60	-0.72	.47
WordType	0.53	1.53	0.35	.73
Congruency*WordType	0.66	2.10	0.31	.75

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

Table 43. The output from the generalized linear-mixed effects models run on TW2 of the second half for the L1 Spanish group (n = 25).

	Estimate	SE	z-value	p-value
(Intercept)	-2.18	1.06	-2.06	.04
Congruency	-0.59	1.58	-0.38	.71
WordType	0.21	1.59	0.13	.90
Congruency*WordType	0.34	2.22	0.15	.88

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

Even though the analysis showed a three-way interaction of Congruency, Word Type and Trial, the split into the first and the second half of the experiment did not show any significant effects. Nor was the interaction of Congruency and Word Type found, which leads us to conclude that the L1 Spanish group did not show a difference in looks to the inanimate referent depending on the L1 gender of the nouns.

2.4.5.3.3. L1 German group.

In the L1 German group, 24 experimental items were used. Figure 33 displays a higher proportion of looks towards the inanimate object in the cognate match condition, starting around 200 ms before the onset of the pronoun. The effect continues after TW2. As for noncognates, the two conditions do not seem to differ throughout the experiment.

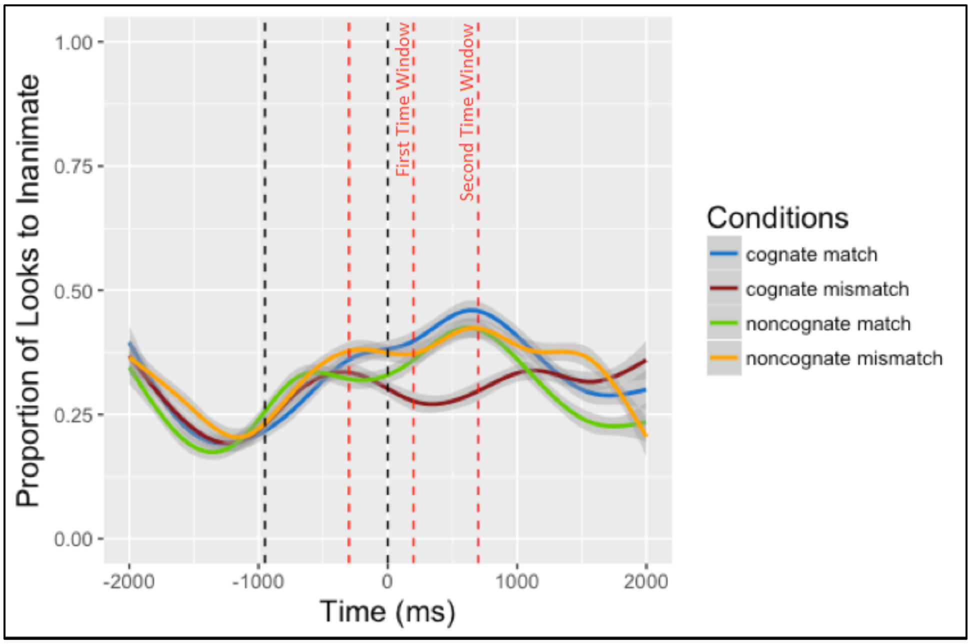

Figure 33. L1 German: Fixation proportions to the inanimate object in four conditions (i.e., cognate match, cognate mismatch, noncognate match and noncognate mismatch) during the visual world paradigm (*n* = 24)

The analysis of TW1 found a highly significant interaction of Congruency and Trial (Table 44). A marginally significant three-way interaction of Congruency, Word Type and Trial was also detected, which will require further analysis of the data by splitting the experiment in half.

Table 44. The output from the generalized linear-mixed effects models run on TW1 for L1 German group (*n* = 24). The fixed factors included: Congruency (match vs. mismatch), Word Type (cognate vs. noncognate) and Trial.

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.18	0.54	-2.18	.03
Congruency	-0.97	0.98	-1.00	.32
WordType	0.17	0.55	0.32	.75
Trial	-0.03	0.07	-0.45	.65
Congruency*WordType	1.12	1.13	0.99	.32
Congruency*Trial	-0.43	0.12	-3.58	**.001**
WordType*Trial	0.08	0.09	0.87	.39
Congruency*WordType*Trial	0.27	0.14	1.89	**.06**

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

TW2 found a main effect of Congruency (Table 45) seen in a higher proportion of fixations for match items, regardless of the Word Type. There was also a highly significant effect of Trial; a two-way interaction of Congruency and Trial; and a three-way interaction of Congruency, Word Type and Trial. Because there was no interaction of Congruency and Word Type, the cognate and noncognate data will not be analyzed separately, but a median split based on Trial will be performed due to the interaction of Congruency and Word Type with Trial.

Table 45. The output from the generalized linear-mixed effects models run on TW2 for L1 German group (*n* = 24).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-0.21	0.57	-0.37	.71
Congruency	-1.82	0.87	-2.09	**.04**
WordType	-0.43	0.79	-0.55	.58
Trial	-0.47	0.08	-5.95	**.001**
Congruency*WordType	1.51	1.22	1.24	.22
Congruency*Trial	-0.31	0.12	-2.61	**.009**
WordType*Trial	0.17	0.10	1.65	.10
Congruency*WordType*Trial	1.21	0.15	7.95	**.001**

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

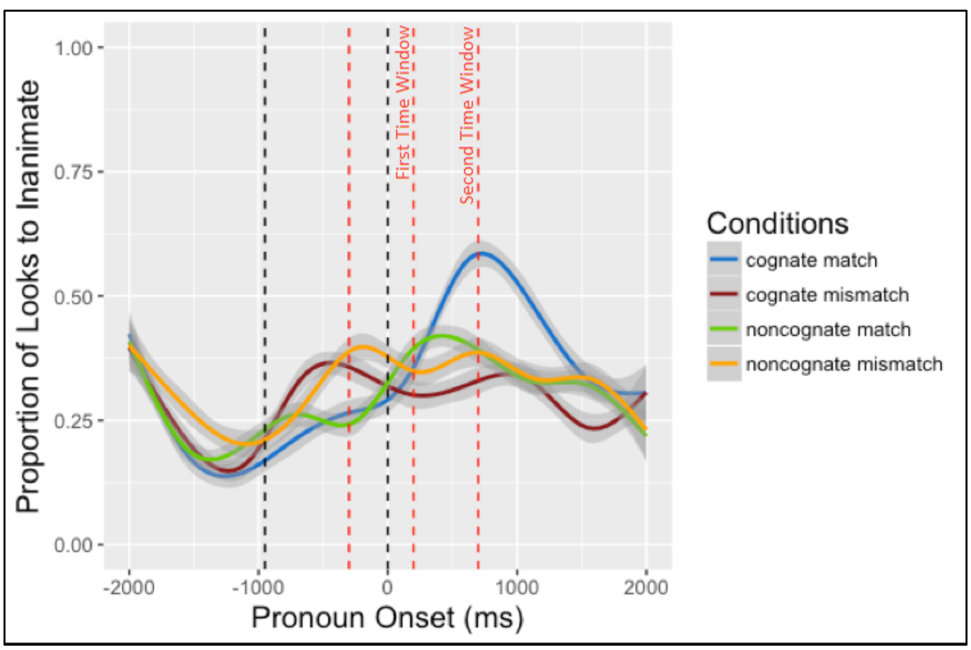

Figure 34. L1 German: Fixation proportions to the inanimate object in four conditions of the first half during the visual world paradigm (*n* = 24)

Figure 34 illustrates the first half of the experiment, which shows a higher proportion of looks to the object in the case of the cognate match than the cognates mismatch condition right after the onset of the pronoun (TW2). Noncognates have more looks towards the incongruent condition in TW1 than the cognates, but the effect disappears in TW2. The results show no interactions nor main effects for TW1 (Table 46).

Table 46. The output from the generalized linear-mixed effects models run on TW1 of the first half for the L1 German group (*n* = 24).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.30	1.59	-0.82	.42
Congruency	-0.83	1.92	-0.43	.67
WordType	0.11	1.88	0.06	.95
Congruency*WordType	1.36	2.52	0.54	.59

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

The analysis of TW2 of the first half only showed a marginally significant main effect of Congruency, which could be seen in a higher fixation proportion for match items. No other effects were found (Table 47).

Table 47. The output from the generalized linear-mixed effects models run on TW2 of the first half for the L1 German group (*n* = 24).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	1.30	1.53	0.85	.40
Congruency	-3.12	1.83	-1.70	**.09**
WordType	-2.32	2.02	-1.15	.25
Congruency*WordType	2.02	2.59	0.78	.44

Formula in R: *Fixation ~ Congruency*WordType*scale(Trial) + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

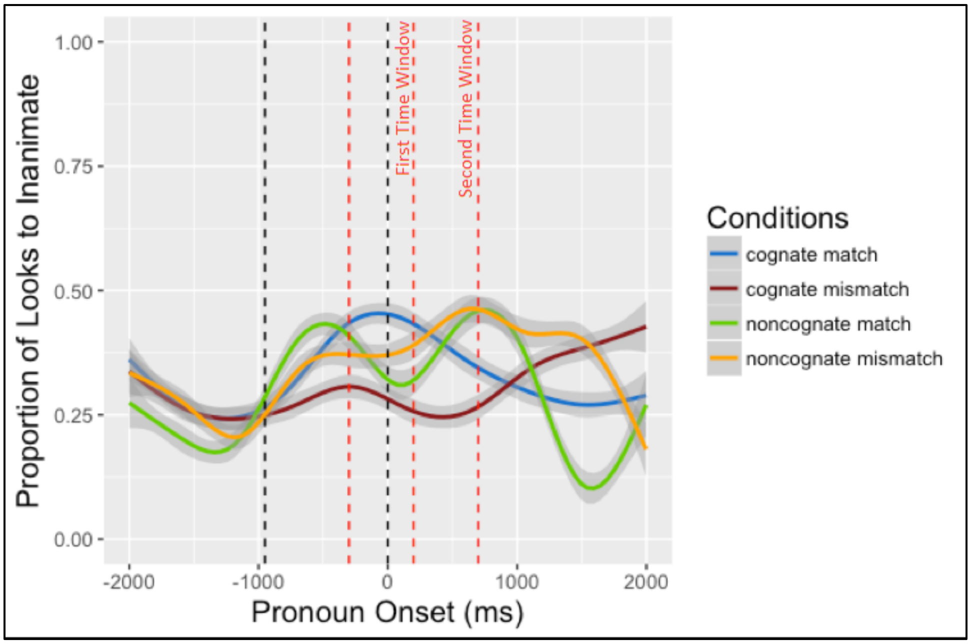

Figure 35. L1 German: Fixation proportions to the inanimate object in four conditions of the second half during the visual world paradigm (*n* = 24)

In Figure 35, the second half of the experiment is displayed. Increased looks when the item is a congruent cognate vs. an incongruent cognate start after the offset of the first sentence and continue until the end of TW2. A difference between congruent and incongruent noncognates is not visible. The analysis done on TW1 showed no significant differences (Table 48).

Table 48. The output from the generalized linear-mixed effects models run on TW1 of the second half for the L1 German group (*n* = 24).

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-2.63	3.25	-0.81	.42
Congruency	-5.22	3.99	-1.31	.19
WordType	0.66	3.88	0.17	.86
Congruency*WordType	4.95	4.63	1.07	.29

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

The analysis on TW2 of the second half showed a highly significant effect of Congruency (Table 49). This means that items that matched on gender with the pronoun also elicited higher proportions of looks. A highly significant interaction of Congruency and Word Type was also recorded.

Table 49. The output from the generalized linear-mixed effects models run on TW1 of the second half for the L1 German group (n = 24).

	Estimate	SE	z-value	p-value
(Intercept)	-3.29	1.88	-1.75	.08
Congruency	-15.26	5.26	-2.9	**.004**
WordType	3.49	2.55	1.37	.17
Congruency*WordType	15.58	5.61	2.78	**.005**

Formula in R: *Fixation ~ Congruency*WordType + (1+ WordType +Congruency|Participant) + (1+Congruency|Item)*

Because the interaction of Congruency and Word Type was witnessed in the second half, the follow-up analysis will analyze cognates and noncognates separately. In TW1 of the second half, a significant main effect of Congruency was recorded only for cognates (β = -10.03, SE = 3.88, z = -2.59, p = **.01**). Noncognates showed no effect. In TW2, Congruency was significant for cognates (β = -50.06, SE = 6.48, z = -7.73, p < **.001**), but not for noncognates. The effects of Congruency on TW1 and TW2 were visible in more looks towards the cognates that matched in gender (see Appendix A: IV for more detail). Although the overall analysis of the two time windows showed a three-way interaction of Congruency, Word Type and Trial, the effect was not seen in the first half of the experiment. This means that only in the second half of the experiment did L1 gender co-activation occur and only with words that overlapped in meaning and form.

2.4.6. Overall summary.

Three groups with different L1s were tested (Croatian, Spanish and German) on L1 grammatical gender activation in the L2. The participants were all university students with a similar age that were tested on proficiency, cognate facilitation and gender congruency. The proficiency test LexTALE found that the L1 Spanish group had a significantly lower proficiency in English. However, the CFT did not show statistical differences between groups. Two tasks were used to measure the cognate facilitation effect, namely, the LDT and the PNT. In the LDT, participants were asked to decide if a word displayed on the screen is an existent word in a given language under 3500 ms. When it came to the LDT results, the L1 Spanish and the L1 German group displayed shorter RTs for cognates than for noncognates in their L1 and L2. L1 Croatian learners did not make any difference when processing cognates vs. noncognates, even when the words matched in length, frequency and neighborhood size. In the PNT, participants were asked to name objects shown on the screen in a target language. Again, only the L1 German and the L1 Spanish group showed slower response rates for noncognates when compared to cognates. This means that, aside from the L1 Croatian learners of English in the LDT and PNT, a cognate facilitation effect was obtained in word production and recognition with the other two groups. Even after matched words in the analysis for the L1 Croatian group, the learners showed tendencies towards the cognate facilitation effect, however, the effect did not reach significance. The results mostly support the non-selective access hypothesis stating that both languages in a bilingual are stored in the same lexicon and activated at all times.

As for the visual world task during eye-tracking, participants were asked to listen to a discourse while simultaneously observing a visual scene. While Experiment 1 looked at the L2 discourse, Experiment 2 investigated the language-mixing context. By introducing a language-mixing discourse, the L1 gets an additional top-down activation, which is predicted to increase the chance of a L1 grammatical gender co-activation. The three groups performed differently in L2 online processing of gender agreement. The results of the L1 Croatian group did not show an interaction of Word Type and Congruency for cognates that are congruent in gender with the pronoun; however, an interaction of Congruency, Word Type by Trial in both time windows indicated that there were some changes happening at different points in the experiment. For that reason, the experiment was divided into two halves in order to see if these results show the same effects. The first half of the experiment for the L1 Croatian group did not show increased looks towards the object when the words are congruent in gender. However, in the second half, congruent cognates were fixated significantly more than incongruent cognates in TW1 and TW2. The results were marginally significant. The analysis also showed increased looks for incongruent noncognates in TW2, but that effect cannot be explained by gender congruency.

The L1 Spanish group also showed a three-way interaction between Word Type, Congruency and Trial, which is why the experiment was further analyzed by splitting it in two halves. This time, no significant effects were observed, regardless of the word type, time window and on which half of the experiment was looked at.

Additionally, Experiment 2 tested L1 German learners of English. The results also showed a three-way interaction, which was why the experiment was split in two halves. Effects of gender congruency were visible with cognates in the second half of the experiment, in both time windows. This means that cognates that were gender-congruent with the pronoun were fixated more often than gender-incongruent cognates in the second half of the experiment, starting from 300 ms before the onset of the pronoun until 700 ms after the onset.

The next section will discuss the results of the two studies (Experiment 1 and Experiment 2) in the context of the current production and recognition models and research done so far on the topic of grammatical gender processing. It will look at how the language context affects L1 grammatical gender co-activation and it will look at differences among languages that might have affected L1 co-activation. Moreover, it will discuss the non-selectivity and the representation of gender in the bilingual mental lexicon.

2.5. Discussion

The aim of this study was to investigate L1 grammatical co-activation in a L2 that lacks the feature. In other words, there were two topics to be addressed: (i) under which circumstances the L1 gender co-activation takes place and (ii) which crosslinguistic differences affect the process of L1 gender recruitment in the L2. In order to answer these questions, two experiments were conducted. Experiment 1 tested proficient adult L1 German L2 English learners on L1 gender co-activation during L2 English sentence processing. Experiment 2 introduced three different L1s (Croatian, Spanish and German) in order to test which differences might affect the L1 grammatical gender activation, i.e. the realization of gender, language selection or language family. Moreover, in Experiment 2, participants were exposed to a language mixing context in order to see if additional levels of L1 top-down activation facilitate L1 gender co-activation.

In Experiment 1, proficient adult L1 German L2 learners of English were tested on the cognate facilitation effect (LDT and PNT) and the L1 gender co-activation (visual world paradigm). The LDT and PNT showed faster RTs for cognates than for noncognates in both languages, which supports the non-selective access in word production and recognition, i.e. both languages in a bilingual are stored in the same lexicon and activated at all times. However, no congruency effects were observed in eye-tracking. For this reason Experiment 2 introduced a language-mixing context in order to see if translating the first sentence into participants' L1 would facilitate L1 gender retrieval during a L2 pronoun processing. By introducing a language-mixing discourse, the L1 receive more top-down activation, which is predicted to increase the chance of a L1 grammatical gender crosslinguistic influence. Moreover, in Experiment 2, three groups of adult L2 learners were tested on L1 lexical and gender co-activation.

Since there is much evidence on the co-activation of gender of Germanic languages, especially in the word production studies, L1 German was included in the current study. If L1 gender activation happens in a L2, the probability of it happening with L1 German is very high. Considering that studies on Romance language gave mixed results, L1 Spanish learners of English were included to see if the effect will happen in spoken sentence recognition. Moreover, because there is not much evidence on Slavic languages, L1 Croatian L2 learners we also recruited. The cognate facilitation effect was visible with L1 Spanish and L1 German in both the LDT and the PNT. The L1 Croatian group showed no significant effects, but it showed tendencies towards the cognate facilitation effect.

The groups performed differently during online processing in the language-mixing context. The L1 German group showed the activation of L1 gender, but only in TW1 and TW2 of the second half of the experiment. The L1 Croatian group showed similar results, but the effects were not as strong (i.e., only marginal effects were visible). The L1 Spanish group did not display any significant difference between conditions in any of the time windows. Overall, the results show that L1 lexical information and L1 grammatical gender can be co-activated, but only under certain conditions. The nonselective access seen through cognate facilitation effects is more constant in recognition (LDT) and production (PNT), however, the activation of L1 grammatical gender was less detectable in the visual world paradigm during listening. The only clear evidence in the co-activation of L1 gender were visible with the L1 German group who's results reached significance. Therefore, the study concluded that the activation of L1 gender will happen in a language-mixing context during sentence comprehension, however, the activation is limited to words that overlap in form and meaning (cognates). Moreover, only those learners whose L1 is German or Croatian will co-active L1 gender information. In the continuation, the L1 differences will be discussed in more detail.

Depending if we look at word production or word comprehension, gender assignment or gender agreement, studies have provided mixed evidence for the activation of gender. Word production studies on bilinguals focused on testing two hypotheses for L1 and L2 gender representation: the *gender integrated representation hypothesis* and the *gender autonomous representation hypothesis*. L2 studies on bare noun and noun phrase production found evidence for the *gender integrated representation hypothesis* with Germanic languages (Lemhöfer et al., 2008), but less so with Romance languages (Costa et al., 2003). Studies on Slavic languages are scarce, some give support for the gender integrated representation (Bordag & Pechmann, 2007) and some for the gender autonomous representation (Bordag & Pechmann, 2008) in the bilingual mental lexicon. There can be several reasons for why different languages show different results when it comes to L1 grammatical transfer. Table 50 repeats the differences between the L1s used in the study which will be discussed as potential factors for the activation of L1 grammatical gender.

Table 50. Summary of the gender feature in Croatian, Spanish and German

	Croatian	Spanish	German
Language family	Slavic	Romance	Germanic
Gender values	masculine	masculine	masculine
	feminine	feminine	feminine
	neuter		neuter
Phonological transparency	transparent	transparent	opaque
Language selection	early	late	early

One of first differences is that languages come from different language families. Yet, L1 gender activation still got support from studies on Romance (Paolieri et al., 2018), Germanic (Lemhöfer et al., 2008) and Slavic (Bordag & Pechmann, 2007) languages. Another possible factor for L1 differences is the complexity of gender assignment. Spanish and Croatian languages have reliable rules on gender assignment to nouns. German has a large list of small-scope rules that have many exceptions (Klassen, 2016a). Therefore, Spanish and Croatian are classified as 'simple' languages and German is a 'complex' language. Because of that Spanish and Croatian languages are phonologically transparent (Teschner & Russell, 1984), as the phonological information reliably indicates the gender of the noun. For German, phonological transparency is not enough to predict the gender of the noun, so German is classified as phonologically opaque (Zubin & Köpcke, 1984). Yet, the L1 Spanish and the L1 Croatian group did not pattern together, so the complexity of the gender assignment system nor the phonological complexity explain my results. Typological differences are also possible factors that influenced the results. Considering that Spanish is a pro-drop language, the introduction of a pronoun in the second sentence might also indicate a topic change (Carminati, 2002). Because the first noun introduced is the topic (*la lampara*), the presence of the pronoun would indicate the topic shifts from the inanimate object to the animate character (*la abuela*). In order to continue to refer to the topic from the first sentence, the pronoun is typically omitted, as all the information (person and number) is already on the verb. However, Croatian is also a pro-drop language (Franks, 1995), and also prefers dropping the pronoun when the topic in the continuation of the discourse stays the same. This means that if the topic continuity hypothesis was a potential factor in the study, then the effect should have also been visible with the L1 Croatian group.

Language selection was one of the explanations for the lack of L1 gender co-activation during L2 picture naming. Early selection languages, German and Croatian in this case, are hypothesized to activate their gender information early in the process as the phonological context is not needed for determiner selection. Croatian does not have articles, but the gender agreement is seen on adjective and pronouns. Spanish, on the other hand, looks at the phonological context in order to recruit the appropriate determiner during online NP production. The additional step of looking at the phonological context before recruiting the determiner can potentially explain the lack of effect for the L1 Spanish group during spoken gender agreement processing. However, in the current study the L1 gender is already activated before the anaphoric pronoun is presented. Moreover, during the adjective-noun gender agreement in Spanish the genders always overlap ('cold water' - *agua*$_{\text{FEM}}$ *fria*$_{\text{FEM}}$), which is not the case with determiner-noun agreement ('the water' - *el*$_{\text{MASC}}$ *agua*$_{\text{FEM}}$). This inconsistency with the gender of the determiner and the gender of the noun should also be absent in pronoun-noun gender agreement (*ella*$_{\text{FEM}}$ 'she' - *agua*$_{\text{FEM}}$ 'water'). The question is whether a late selection of a determiner in Spanish affects the selection of the appropriate pronoun, since the pronoun always has the same gender as the gender of the noun it refers to.

The number of gender values is another possible reason for the lack of L1 gender co-activation. German and Croatian languages have three gender values (i.e., masculine, feminine and neuter) and Spanish language has two gender values (i.e., masculine and feminine). In word production, some studies have shown difficulties in detecting gender congruency effects when the two languages differ in the number of gender values. However, Lemhöfer et al. (2008) found the gender congruency effect in word production and comprehension with Dutch that has two gender values (common and neuter) and German which has three (masc, fem and neut). Quite similarly, Paolieri et al. (2018) found an effect with Russian learners of Spanish, as well as Manolescu and Jarema (2015) with Romanian learners of French. However, the studies mostly focused on bare noun and NP (determiner-noun) processing. Even though English does not have grammatical gender, it still classifies nouns into masculine and feminine (reflecting the biological gender) and neuter (reserved for objects). Following the gender realization in English, the gender congruency effect in L2 English was found in gender agreement studies: from L1 Russian (Cook, 2018), but only with animate nouns; and from L1 Dutch (Conklin et al., 2007), but only with cognates. These studies show that even though the number of gender values might differ in L1 and L2, the effect is still visible.

In this study, however, by introducing the language mixing context, L1 grammatical gender of the noun gets activated in the first sentence, but for some reason it does not get recruited during pronoun processing in L1 Spanish learners. According to the *asymmetric gender representation hypothesis* (Klassen, 2016a), if the two languages are not completely symmetrical in terms of gender values, then the odd value will be target-language-specific (i.e., stored separately from the shared L1 and L2 gender nodes). For example, in Klassen's (2016a) study, Spanish learners of German were tested, which means that the neuter node in this case was L2-specific, but still part of the integrated gender representation system. The activation of the neuter node reduces the inhibition effects because it is not shared across the

L1 and L2, which was supported by Klassen's (2016a) results stating that gender incongruent nouns that were paired up with the neuter value were still named faster than the gender incongruent values that are shared in the system (i.e., masculine and feminine). Yet, the study was limited only to noun processing and did not look at gender agreement in a sentence context between a noun and a pronoun.

The *asymmetric gender representation hypothesis* (Klassen, 2016a) gives a convincing explanation for the lack of gender congruency effects in asymmetric gender system languages, but the evidence for L1 Dutch activation in L2 German (Lemhöfer et al., 2008) or L1 Dutch activation in L2 English (Conklin et al., 2007) shows that even though two languages are asymmetric, the L1 co-activation still occurs. This leads me to conclude that there is something intrinsic to the neuter value that interferes with the L1 transfer during L1 pronoun processing. In Experiment 2, the first sentence introduces the L1 grammatical gender. That means that not only is the L1 noun activated, but the L1 gender along with it. The two languages (L1 and L2) activate their genders, which would result in L1 Spanish and L2 English storing the masculine and the feminine value as shared nodes, and the neuter value would be L2-specific. Considering that there is no neuter value in the L1, the signal that there is no L1-L2 overlap of the neuter node is sent back from the L2 neuter value to the shared gender system, which interferes with a further recruitment of the L1 gender, i.e. the L1 gender gets inhibited. This would especially be the case with the gender agreement of a noun and the anaphoric pronoun, because there is enough time for the inhibition in non-local dependencies to develop compared to noun phrase gender agreement. The chances of recruiting the L1 grammatical gender of the inanimate referent would decrease in time, which is why the L1 gender activation would be reduced. The status of the neuter value would explain why there is L1 gender activation when languages are asymmetric, but share the neuter gender value (e.g., Dutch-German and Dutch-English combination). Yet, the hypothesis is in early stages, which means that more research has to be done in order to understand the nature of neuter value and the gender system overall.

Going back to the approaches to L2 acquisition and L2 processing, the results of Experiment 2 do not go hand in hand with the predictions the SSH (Clahsen & Felser, 2006) makes. As crosslinguistic influence does not play a major part according to the SSH, there should be no difference between L1 groups, as they are all predicted to process L2 sentences in a non-native like way. The FRH (Lardiere, 2009) looks at how many steps learners have to go through in the reassembly stage, and according to the thesis, L1 Spanish learners might potentially have to go through fewer steps considering that they have one less gender value that should be combined and associated to the gender of animate entities. Because Spanish does not have neuter grammatical gender, there are less features to be reassembled. According to learned attention, presented by Ellis and Sagarra (2010b), L2 learners of English should have no problem in detecting L2 gender cues, as they are already present in their L1. According to these accounts, only the FRH could potentially explain the selectivity in crosslinguistic influence.

2.5.1. Limitations.

The study also includes limitations that might have affected the results. For example, the three L1 groups differed on various aspects. Firstly, the L1 Croatian and L1 German participant were students majoring in English. The L1 Spanish group, on the other hand, were students of English, but also any student at the university who had a high proficiency in English. Secondly, the number of participants differed between groups. The L1 Croatian group had 41 participants, while the other L1 groups only had fewer than 26 participants each. Moreover, the L1 Croatian group was on average younger than the L1 Spanish and L1 German group. The age of the onset also differed, with the L1 Croatian group having started the acquisition of English earlier than the L1 Spanish group, and with L1 German group being the group that started learning English the latest of the three. In terms of English language proficiency, the English LexTALE showed that the L1 Croatian and L1 German group outperformed the L1 Spanish group on their English vocabulary knowledge. However, the results for the CFT were the same across groups, indicating that there are no differences in L2 English proficiency between the three groups. Moreover, L1 co-activation is usually stronger with low-proficiency L2 learners (Dijkstra, 2005), which means that the strongest effect should have been found precisely with the L1 Spanish group.

The choice of items for the LDT, PNT and the main experiment was also affected by various factors. Especially in the case of the L1 Croatian group, cognate and noncognates did not match in length, frequency and neighborhood size in English, and only in length in Croatian. The number of items was also different among groups, counting 24 items for the L1 German group and 32 items for the L1 Croatian and L1 Spanish group. The reason for having such a low number of items in the main experiment for L1 German is because the neuter value is frequent in German and this limited the choice of concrete words with either masculine or feminine gender that could also be visualized in the PNT and the eye-tracking task. The experiment also included passive sentences, which are grammatically correct in all languages, but very infrequent in each L1 in this study. The frequency of passive forms was high in the experiment, as the first sentence for each filler and experimental item was always in a passive form.

Finally, the audio files used in the language-mixing main experiment would have ideally been recorded by an early bilingual of the respective L1 and L2. Since it was difficult to find bilinguals for all three experiments, the study limited itself to choosing teachers of English, whose language was one of the L1s used in the study, with a high L2 proficiency who did not have a strong accent in the L2. Moreover, in the case of Croatian items, a Serbian native speaker was recruited for audios because of time constraints and limited resources, which might have affected the results. However, the items in Croatian were words taken from a Croatian corpus and were pronounced in an authentic way.

2.5.2. Conclusion.

In summary, the current study looked at L1 grammatical gender co-activation during L2 English pronoun processing. The results of the first experiment showed that the co-activation of L1 German grammatical gender occurred on the word level (i.e., in the PNT), but was absent in spoken sentence recognition. However, in both Experiment 1 and Experiment 2 the lexical activation of the L1 and the L2 was visible in word production (PNT) and word recognition (LDT) in participant's L1 and L2, with an exception of L1 Croatian. Therefore, the results support the bilingual lexicon model arguing for non-selective access during L1 and L2 language recognition (BIA+ model, Dijkstra & Van Heuven, 2002). However, when it comes to L1 grammatical information (formal gender), the co-activation was visible only with L1 German and L1 Croatian learners of English. The FRH lends itself as a good theoretical background to explain the inconsistency in L1 gender co-activation and the crosslinguistic influence on in the L1 Spanish group. Moreover, the effect was obtained when there was gender overlap, accompanied by additional lexical overlap (i.e., cognates).

The presence of the L1 gender co-activation in the current study also supports the *gender integrated representation hypothesis*. The activation of gender was only absent with

L1 Spanish learners of English. The study at hand gives support for the L1 grammatical and lexical activation during online spoken comprehension, however, the L1 grammatical gender co-activation is limited by various factors. Firstly, the L1 gender activation was absent in a purely L2 setting. By introducing a language-mixing context, the top-down activation of the L1 made the L1 gender recruitment into the L2 possible. Secondly, the effect was only visible for cognates because of a higher overlap between L1 and L2 which facilitated the activation of both languages in the mental lexicon. Also, the effect was visible with Croatian and German learners. A possible reason might be the neuter value status which blocks the activation of the L1 grammatical gender when one of the languages lacks the neuter value. In future research, it would be interesting to see if the neuter value status has an effect in languages that are not in the Romance language family (e.g., Hebrew, Irish and Arabic). Moreover, more studies are needed with asymmetric gender systems, especially in sentence recognition and gender agreement in a sentence context in order to be able to understand the way grammatical gender of L1 and L2 is represented, and how the gender is mapped and recruited for use. In terms of retrieval, we need more evidence in order to understand the differences during online production and comprehension, if there are any, and to test the limits of L1 co-activation of grammatical gender during L2 gender agreement processing.

3. Study 2: Present Perfect Tense

3.1. Introduction

Crosslinguistic influence has been observed in L2 processing on various levels, mostly obtaining evidence from studies on the lexicon (Lemhöfer et al., 2004), but less on grammar (Roberts & Liszka, 2013). Second language acquisition (SLA) theories, such as the FT/FA (Schwartz & Sprouse, 1996) and the FRH (Lardiere, 2009), have advocated for L1 influence, as well as models of L2 sentence processing, such as tuning models (Cuetos et al., 1996; Mitchell & Cuetos, 1991). Even though crosslinguistic influence might not be the main factor for all differences between L1 and L2 acquisition and processing, it has been recorded in various studies, in particular in studies on L2 processing, among others.

Languages differ on various levels, but also in terms of the encoding of tense, i.e. tense can be encoded lexically (e.g., Chinese) and/or morphologically (i.e., English). The topic of tense in L2 acquisition has been of interest to researchers, as various studies have shown that L2 learners usually do not use L2 tense in a native-like manner in production (Bardovi-Harlig, 2000). Research on production has shown that L2 learners have problems in using tense, even though they might be native-like on receptive knowledge of tenses (Bardovi-Harlig, 2000; Sabo, 2014). Some studies on tense production (Liszka, 2004; Yoshimura, Nakayama, Fujimori, & Sawasaki, 2014) outline possible L1 effects influencing the underperformance of L2 learners. Other studies have found effects of proficiency, instruction and age of acquisition influencing the use of L2 tense (Fuchs, Götz, & Werner, 2016; Yoshimura et al., 2014).

Research so far has mostly focused on testing the production of L2 tense, yet, the use of tense information in real-time can give researchers a clearer picture of the optionality in L2 tense use and if the optionality also happens in comprehension. Implicit knowledge, i.e. knowledge available for automatic processing (Ellis, Loewen, & Erlam, 2006), has been tested with an eye-tracking method, ERPs and a self-paced reading (SPR) task, and it mostly focused on mismatches between a fronted temporal adverbial and verb tense. Comprehension studies on online processing of tense were consistent with the findings claiming that monolinguals use L1 inflection in real-time (Baggio, 2008; Steinhauer & Ullman, 2002). Research on L2 online processing of tense found support for L1 tense co-activation (Chan, 2012), possible L1 aspect co-activation (Roberts & Liszka, 2013), but also some studies did not witness crosslinguistic influence (Eriksson, 2016; O'Reilly, 2018). Chan (2012) argued that the presence of grammaticalized tense in L1 affected the sensitivity to online L2 tense mismatches. Roberts and Liszka (2013) claim that the presence of grammaticalized aspect in L1 guides the sensitivity to L2 present perfect tense mismatches, while some studies found no sensitivity to coreference violations of tense in L2 (Eriksson, 2016; O'Reilly, 2018) or L1 (O'Reilly, 2018) speakers during online L2 processing of tense.

The current study is based on a study by Roberts and Liszka (2013) which hypothesizes that differences in the L1 aspectual realization affect native-like real-time use of L2 tense. More precisely, the study used coreference violations between temporal adverbials (e.g., *yesterday* vs. *since yesterday*) and verbs (i.e., past simple vs. present perfect). Roberts and Liszka (2013) argue that only those L2 learners whose L1 grammaticalizes aspect (i.e., French) are successful at detecting tense agreement violations, opposed to L1 German L2 learners whose L1 lacks grammatical means of encoding aspect. The study at hand aims at trying to disentangle possible factors, such as L1 aspect and tense realization, in L2 tense processing found in previous studies (Chan, 2012; Roberts & Liszka, 2013). In order to do so, the study chose three L1 groups (i.e., German, Croatian and Spanish) whose L1s differ in aspect, tense and present perfect realization. The study examines (i) if the presence of grammaticalized aspect in an L1 (Croatian and Spanish) affects the sensitivity to tense mismatches or (ii) if only those L2 learners whose L1s have a tense that is the same in form and meaning to English present perfect (i.e., Spanish) will show native-like processing of the L2. The results of the study do not show sensitivity to tense mismatches in any of the L1 groups, which means that the two factors (i.e., grammatical aspect and present perfect tense) do not guarantee sensitivity to English tense mismatches in L2 sentence comprehension. The results will be discussed with regards to previous research.

3.2. Temporal Adverbs and Temporal Verbal Morphology

Time is a crucial component to human conceptualization and it can be linguistically encoded in several ways. Tense and aspect both give an information about time in different ways, and can be expressed lexically or grammatically in different languages. For example, in lexical terms, if a person wants to express that something happened in the past, they could use a temporal adverbial *yesterday*. Temporal adverbials have been used as lexical means to express temporality in both languages that mark tense grammatically and in languages that only express it lexically. The same notion of a past event can be expressed morphologically on verbs with an inflectional suffix *–ed* in English. However, not all languages mark tense or aspect morphologically. This section will deal with the topic of tense and aspect in more detail and will discuss their encoding in English.

3.2.1. Tense.

Time can be divided into past, present and future on a timeline (Figure 36). Actions, events and states can differ in duration (i.e., aspect) and can be located anywhere on the timeline (i.e., tense). Therefore, tense locates a situation in time in relation to the utterance, and aspect looks at the structure of time of an event (Comrie, 1976). In these terms, tense is described by Comrie (1976, p. 5) as the 'situation-external time' and aspect as the 'situation-internal time'. Figure 36 illustrates the division of time according to tense and aspect by Ayoun and Salaberry (2008). As it could be seen in the figure, aspect is divided into grammatical and lexical. Grammatical aspect is realized grammatically on the verb and lexical aspect is an inherent part of the word (e.g., verb) that expresses the situation or action (Andersen & Shirai, 1994). Lexical and grammatical aspect will be discussed in more detail in Section 3.2.2.

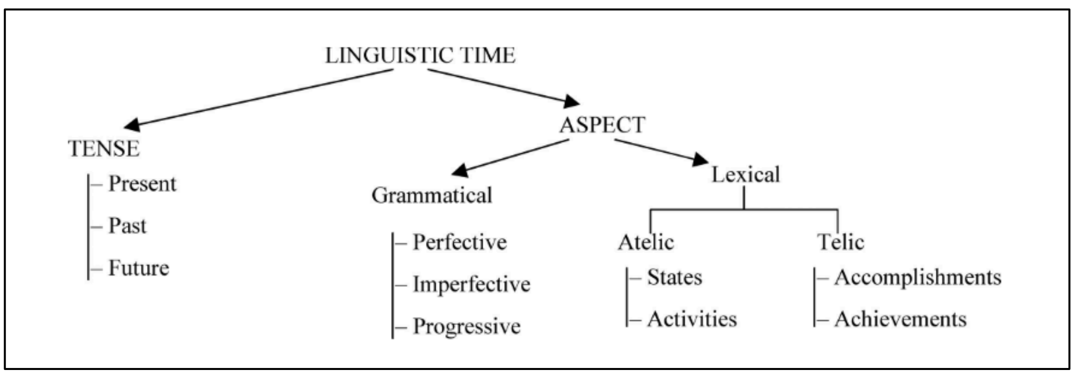

Figure 36. Division of time by tense and aspect (Ayoun & Salaberry, 2008, p. 558)

Therefore, tense locates an event on the timeline, but it also expresses the relation between the target event and the time of speaking. Reichenbach (1947, p. 290) proposed a semantic analysis of events in time. Reichenbach (1947, p. 290) lists three notions of time: the speech point or the time of utterance (S), the reference point or the viewpoint (R), and the event point or the described action's location in time (E). Reference point can happen at the same time (=R), before (<R) and after (>R) the speech point and the event point (Figure 37). In (a) in Figure 37, the reference time, event time and speech time all happen at the same time (i.e., present simple). In past simple (b) the event point and the reference point are in the past, before the speech time, indicating a completed event. In present perfect (c), however, only the event time is in the past, but the reference time and the speech time are in the present. Past perfect (d) locates time points one after the other, namely, event time before reference time before situation time. Yet, in example (e) the event point is in the future, preceded by the speech and the reference time. Reichenbach (1947) also points out that tense and aspect interact and can share ending on verbs in order to convey both temporal categories. However, Reichenbach's (1947, p. 290) reference point theory does not look at events as durable (i.e., time spans) and potentially overlapping with other events, but it sees events referring to a point in time.

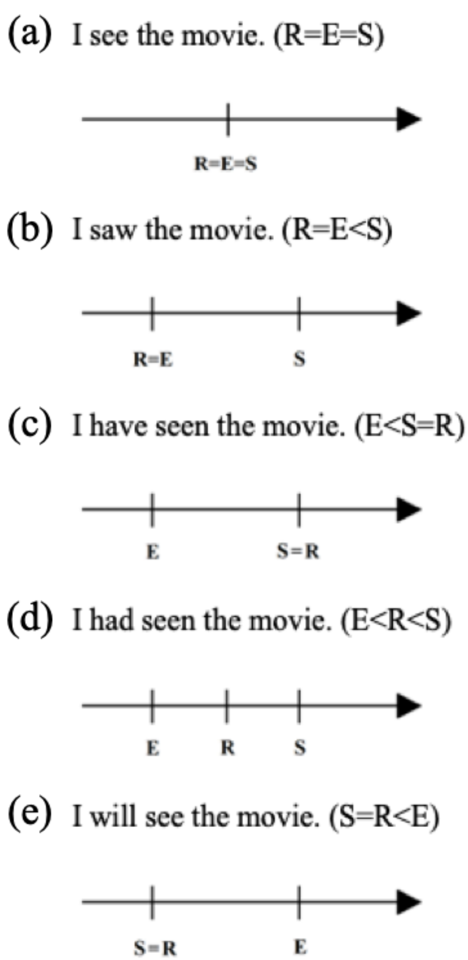

Figure 37. The order of Reichenbach's (1947) three notions of time based on English tense

Based on Reichenbach's (1947) semantic analysis of tense, Klein (1995) also distinguished between three temporal events (i.e., topic time, time of the utterance and situational time) that help establish relations between events on the timeline. The topic time (TT) talks about a point in time located in past, present or future which concerns an event being talked about. Time of the utterance (TU) is the point in the time when the speech event occurred. Finally, the situation time (TSit) refers to the time span at which the situation occurs, which may precede or follow the topic time (Klein, 1995). Klein (1995) hypothesizes that only the situation time can express aspect (i.e., the internal makeup of the event), i.e. the relation of events as happening simultaneously or before/after one another.

Tense can be divided into past, present and future (Klein, 1995). This distinction of tenses can be realized morphologically in English for present (1) and past (2). Future, on the other hand, is realized periphrastically (3):

(1) Ian advocates for mental health. (TU including TT)

(2) Ian advocated for mental health. (TU after TT)

(3) Ian will advocate for mental health. (TU before TT)

In (1), the inflection on the verb indicates that the action is set in the present. This means that the TU and TT happen at the same point in time. Even though English is not as morphologically rich when it comes to inflections as some other languages (e.g., Spanish and Croatian), the inflection is still visible on third person singular for present simple. Past simple is morphologically realized through –*ed* suffix on regular verbs (e.g., *advocate*) and it indicates that the TT precedes the TU. On the other hand, future tense uses the auxiliary verb *will* with the main verb in infinitive to signal that the topic time is in the future, hence the TU happens after the TT. Therefore, tense is realized morphologically on third person singular for present simple, for all persons and numbers in past simple, while the future tense does not add an inflection, but an additional auxiliary verb to signal the TT location in future.

English present perfect is introduced in (4) and it is defined as a the TSit happening after the TT, before the TU. Present perfect has been a topic of debate, especially if it should be defined as tense, aspect or a combination of both. Different researchers define it as a tense (Radden & Dirven, 2007) and others as an aspect (Comrie, 1976). The current study will take into consideration the specific status present perfect has in the English language when analyzing the results.

(4) Ian has advocated for mental health. (TSit after TT)

Present perfect is an event with location in the past, but it differs in aspect from past simple. Past simple refers to a completed event in the past, i.e. before the time of the utterance (Comrie, 1985). It can refer to a point in time or a time period that happened in the past (5). Present perfect, on the other hand, is used for states, activities and habits that continue up to the present (König & Gast, 2007, pp. 91–92). This type of present perfect is also called *perfect of persistent situation*, i.e. an event which has a beginning in the past and lasts until the present (Comrie, 1976). For example, a sentence like in (6) indicates that the event has happened in a span of time than is still continuing until the present. *Perfect of persistent situation* is usually used in combination with adverbials such as *since, for, so far, up to now.*

(5) I went running every day for one year.
(6) I've lived in London since I was 5.
(7) He has arrived.
(8) I've just finished doing my laundry.
(9) I have watched the movie.

Another use of present perfect is as the *perfect of result* (Michaelis, 1994). In this case, the tense can be used to talk about the result of the past event in the present (7). In this case, the reference point is in the present, but the event happened in the past. Usually, temporal adverbials such as *yet*, *already* and *just* are used for perfect of results. *Perfect of recent past* (McCawley, 1971) describes a past event with present relevance. In other words, present perfect is used when an event has taken place recently and is new to the addressee (8). It is usually combined with adverbials *just* and *already*. Finally, *experiential perfect* (Matthews, 1987) talks about an action that happened at least once in the past, but the moment of the event is not specified (9). Because only past simple is used to refer to the narration of completed events in the past, adverbials such as *yesterday* and *last week* are reserved for this tense, and are not possible with present perfect. Therefore, English clearly distinguishes between past and present events, and treats past completed events (i.e., past simple) and past events with current relevance (i.e., present perfect) differently. In the continuation, the classification of aspect will be discussed, which will later be followed by the instantiation of aspect in English.

3.2.2. Aspect.

As already mentioned in Section 3.2.1, aspect is described as a speaker's viewpoint on the situation. Grammatical and lexical aspect differ in terms or realization (Figure 36), which is, morphological for grammatical aspect and word inherent for lexical aspect. This section will first cover grammatical aspect.

Comrie (1976) divided grammatical aspect into, on the one hand, having an external (outside) point of view when looking at an event (i.e., perfective viewpoint), i.e. not looking at the internal temporal structure (Figure 38). On the other hand, imperfective viewpoint is described as looking at a situation from the inside (within) and seeing its internal structure. In simple terms, aspect denotes taking different perspectives with regard to a situation, such as completed (outside) vs. ongoing (inside) perspective. This division of aspect into perfective and imperfective is common to Slavic languages, and is currently used as the main division that might encompass other sub-aspects (such as habituality and progressiveness). However, not all languages encode perfectivity and imperfectivity grammatically, for example, English.

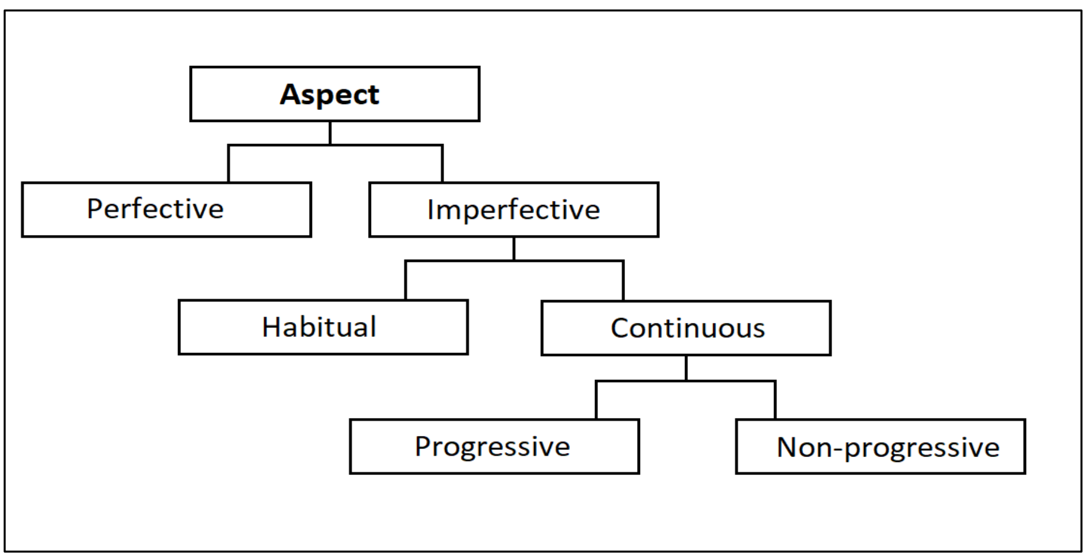

Figure 38. Classification of aspectual oppositions (adapted from Comrie, 1976, p. 25)

English does not encode the perfective/imperfective distinction, but it distinguishes between simple and progressive aspect. Simple refers to an event that is completed and has an endpoint (10) and progressive refers to an event that was ongoing (11).

(10) Phillip parked the car.
(11) Phillip was parking the car.

This means that English grammaticalizes only simple and progressive aspect, but not the perfective/imperfective distinction. However, the progressive aspect is included in imperfective aspect (Figure 38) because the role of imperfective aspect is to express more meanings than progressiveness. As it could be seen in the figure, imperfective aspect also encompasses habituality, which is expressed in English though the use of *used to* or *would* (e.g., *My sister used to play alone when she was younger*).

So far, the chapter has talked about grammatical aspect, which is realized morphologically on verbs in some languages. Lexical aspect, on the other hand, is not explicitly encoded in morphology, but is an inherent part of the word that expresses the situation or action (Andersen & Shirai, 1994). Lexical aspect, also known as *Aktionsart*, refers to a different internal temporal structure of verbs. Vendler (1967) divided verbs into states, activities, accomplishments and achievements according to the aspectual classification of predicates. The explanation for the taxonomy is that tense and aspect interact with and are restricted by predicates. Telic predicates (i.e., predicates that have an endpoint), like accomplishments, are predicted to occur more with the perfective form, and atelic predicates (i.e., predicates that do not have an endpoint), like actions, are more likely to occur with the imperfective form. More on the taxonomy of aspect will be discussed in Chapter 4.

3.2.3. Summary.

To sum up, tense locates a situation in time (past, present and future) and can be realized grammatically and lexically. An event can always be looked at in relation to three events on a timeline: topic time, time of the utterance and situational time (Klein, 1995). English encodes past and present morphologically, while the future tense is realized periphrastically (a combination of a modal verb *will* and the main verb in infinitive). When it comes to aspect, it can be divided into lexical (inherent) and grammatical (viewpoint aspect). Lexical aspect is concerned with the internal structure of a verb and distinguishes between states, activities, accomplishments and achievements. Grammatical tense is realized morphologically on the verb, and it includes perfective aspect (external viewpoint) and imperfective aspect (internal viewpoint). Imperfective aspect further encompasses habituality and progressiveness. English grammaticalizes only simple and progressive aspect, but does not encode the perfective/imperfective distinction seen in Slavic and Romance languages. Due to differences in tense/aspect realization among languages, studies on L2 acquisition have been interested in how the difference between L1 and L2 may affect the acquisition of L2 tense/aspect. In the following, studies on L2 production of tense will be covered.

3.3. Production Studies on L2 Tense

The acquisition of tense and aspect has been a challenge for many English language learners, such as learners whose L1 is Japanese (Uno, 2014), Spanish (Teran, 2014) and Russian (Chernaya & Derevyanko, 2010), among many others. It has been argued that L1-L2 tense similarities lead to more successful L2 acquisition of tense than when tense is grammatically instantiated in the L2 (see Hawkins & Liszka, 2003; Roberts & Liszka, 2013). For example, research on L1 Chinese learners of English, whose L1 lacks grammaticalized tense, showed that the learners are not consistent in their use of past simple (Hawkins & Liszka, 2003; Lardiere, 1998).

Most research studies on L2 tense and aspect focused on how lexical (inherent) aspect affects L2 acquisition, claiming that the acquisition of tense and aspect follows a particular pattern and is guided by lexical aspect of the verbs (Bardovi-Harlig, 1992, p. 130). The Aspect Hypothesis (AH) states that lexical verb classes (*Aktionsart*) interact with grammatical tense and aspect which results in learners acquiring the verb morphology in a specific order (Andersen, 1991; Andersen & Shirai, 1994). In other words, past simple and present perfect are most often associated with telic verbs (*write, kick*), as they denote events with an endpoint (such as accomplishments and achievements). Progressive is associated with atelic verbs (*love, swim*) as it reflects an ongoing activity or a state that does not necessarily have an endpoint. The following studies on tense and aspect have mostly focused on the AH, however, they will be discussed from the point of view of L1 crosslinguistic influence.

One of the pioneer studies on L2 tense acquisition was a study by Bardovi-Harling (1992) which tested 135 adult learners of English as a second language (ESL) with 14 different L1s. The participants performed three tasks, i.e. a cloze test, a written composition test and a multiple-choice test, and the results showed that the learners could adequately detect grammatically correct verb forms, yet, this did not translate in their use. Even though the study (Bardovi-Harlig, 1992) did not find L1 effects per se, it opened a discussion on the issues L2 learners have with learning tense. It showed that learners perform more target-like in their passive knowledge, but were not as successful at using L2 tense in writing. However, the use of L2 was more successful at a higher proficiency.

In a study by Collins (2004), the AH was investigated by testing 139 L1 French and L1 Japanese learners of English using a cloze task and a written retelling of a silent film. The results showed that both L2 learner groups were more accurate in using past simple and present perfect with telic than with atelic verbs. However, the effect was bigger for L1 French learners. The explanation Collins (2004) gave is that there might be an influence of the L1 (i.e., French *passé composé* tense affecting the interpretation of English present perfect) seen in differences between L1 French and L1 Japanese learners, but that the AH still had an effect on the learners' use of telic and atelic verbs in both groups.

A study by Ayoun and Salaberry (2008) did not find support for the AH, but found L1 influence, when testing 21 advanced L1 French learners of English. The narrative task found that L1 French learners used stative verbs more consistently than telic verbs with present perfect and past simple, but the results of the cloze task replicated Collins' (2004) results that past tense morphology is used more with telic predicates. The authors (Ayoun & Salaberry, 2008) also argue for possible L1 effects under certain conditions, since some participants used present perfect systematically for past completed events with dynamic verbs, but not with stative verbs. Yet, the study does not explain what the factors for selective crosslinguistic influence would be.

The acquisition of present perfect presents itself as a particularly challenging aspect of English that emerges in the 'late' stages of English acquisition as an L2 (Julia, 2011). Because present perfect has several meanings, Uno (2014, p. 34) separated a perfective use of present perfect, i.e. experiential use as a completed event (*I have seen the movie*), and an imperfective use such as a situation 'leading up to the time of the utterance' (*I've lived in*

London since I was five) in her study. The study tested 29 L1 Japanese learners of English with different proficiency levels using a cloze test. The task consisted of several passages with verbs in infinitive that should be put in the correct tense form in the context with or without durative adverbials. Based on the AH, the learners were predicted to use the present perfect tense with both telic and atelic verbs, but the results showed that the learners used it only with atelic verbs. The results showed no support for the AH nor for crosslinguistic influence. However, the study by Teran (2014) found support for L1 influence. Thirty-eight intermediate and 47 advanced L1 Spanish learners of English were tested in their use of present perfect in a forced-choice elicitation task. The results showed that present perfect (with an imperfective meaning) was mostly used with atelic verbs and that the learners used present perfect with a perfective meaning (i.e., experiential use as a completed event) only with telic verbs. Yet, the first use of present perfect to be acquired was the imperfective use seen in a more correct use than the perfective use of present perfect. Therefore, the AH gets a partial support. The author (Teran, 2014) argues that the inconsistency with the use of present perfect with atelic verbs is mostly due to the fact that Spanish also has an option of using present simple to express persistent situations, which is ungrammatical in the L2 English. The lack of target-like present perfect use in English is explained by L1 effects.

Liszka (2004) conducted a study on the acquisition of English present perfect by L2 learners from three different L1s (i.e., 12 Chinese, 12 German and 12 Japanese) with a comparable proficiency in English. The study used a task where the learners were asked to complete sentences with appropriate forms, in order to analyze the contrast between present perfect with past simple and present simple. The task used 120 sentences, 54 which were supposed to be in present perfect tense. The task also included real and invented verbs in order to see if L1 speakers use the same morphological rules for tense as L2 English learners. The participants were given 6 definitions of verbs per page and were instructed to use each verb once in the text. Half of the time the task was to give an answer in written and half of the time the answers were supposed to be spoken. All groups performed at chance, meaning that they scored correctly around 50% of the time, leading the authors to believe that the non-native-like use might be due to their L1 grammaticalization of tense. The L1 Japanese and L1 Chinese group used past simple and present simple when present perfect was required, but the L1 German group mostly preferred the past simple form considering that German grammatically instantiates preterit meaning. Because the learners lacked the grammatical means to express current relevance, they relied mostly on lexical means (i.e., adverbials). Therefore, the study again confirmed that the L1 learners are not able to apply present perfect successfully in production.

Another study on L1 influence tested 121 L1 Japanese learners of English, 17 Japanese monolinguals and 34 English monolinguals (Yoshimura et al., 2014). The participants were given a truth-value judgement task, meaning that they had to read short passages and to judge if a given concluding sentence (in past simple or present perfect) sums up what the passage was about. The study used two tenses (past simple vs. present perfect) with two contexts (durative vs. non-durative). In English, past simple and present perfect can both signal a past event that lasted for a period of time (i.e., time span), but in Japanese, a past tense *–ta* morpheme can only signal that it is an event in the past, but excludes the 'durative' nature of English past tenses (i.e., progressiveness vs. non-progressiveness). Therefore, the prediction was that L1 Japanese learners would not be target-like in the acquisition of the 'durative' aspect of English past simple. The results showed that L1 Japanese L2 English learners had difficulties with durative events in past simple and present perfect. The study suggests that the learners were influenced by their L1 tense grammar (i.e., Japanese *–ta* morpheme) in the acquisition of English tense and aspect because tenses in Japanese are not specified for duration. Intermediate and advanced learners showed native-like use of present perfect, which further supported proficiency effects.

A corpus-based study by Fuchs et al. (2016) looked at data from L1 German learner and English native-speaker corpora. The analysis revealed that present perfect is almost never used in the beginning stages by the learners, but the use slowly increases in time and it reaches native-like proficiency only among university learners who had been exposed to English more than ten years at school. Also, there was an effect of instruction (i.e., formal instruction aided the present perfect use) and an effect of age of acquisition (i.e., earlier acquisition led to better results), and both were mostly visible in written narratives.

In sum, research on tense and aspect production mostly focused on testing the AH and the results were mixed (Ayoun & Salaberry, 2008; Collins, 2002; Teran, 2014; Uno, 2014). Other studies found that comprehension usually precedes use (Bardovi-Harlig, 1992; Sabo, 2014) and that the more proficient learners are, the better their command of tenses is

(Bardovi-Harlig, 1992). Other factors that affected L2 learners use of tense were the L1 (Liszka, 2004), instruction, age of acquisition and task type (Fuchs et al., 2016). Although the research looked at English tense production by focusing on the predictions the AH makes (i.e., lexical aspect), many studies also showed L1 effects. Studies mostly focused on production, however, the comprehension of L2 tense comprehension is also important for the L2 acquisition of tense. Different methods (i.e., online and offline) can give a clearer picture as to how learners acquire and use L2 tense information, and which factors are important in the process in comprehension and production. The following section will address the incremental use of tense during real-time processing and the findings of the research done so far.

3.4. Comprehension Studies on L2 Tense

Studies on real-time processing of tense used a variety of online methods, such as ERPs and the SPR task. Some of the first studies focused on the use of adverbials as lexical means for creating a temporal context (i.e., temporal markers). Studies on online processing analyzed monolingual speakers in their processing of temporal adverbials during comprehension. If a sentence is introduced by a temporal adverbial, the information about the time on the adverbial is used in order match the tense of verbs in the rest of the sentence, i.e. creating a specific context which requires a specific tense (Trueswell & Tanenhaus, 1991). For example, the sentence in (12) uses a temporal adverbial *yesterday* that suggests that the rest of the sentence should use a tense that denotes a past completed event (i.e., past simple tense).

(12) Yesterday, I walked the dog.

The first study to use adverbials at the beginning of a sentence as a topic was in French by Fonteneau, Frauenfelder, and Rizzi (1998). The study tested French speakers on adverb-verb tense matches (13a) and mismatches (13b) using ERPs (Fonteneau et al., 1998, p. 119). The adverb at the beginning of the sentence locates the event in the future, which signals the rest of the sentence that the verb should also use grammatical ways to denote a future event. The results of the study showed positive peaks and negative drops that do not fit any of the classes used to express grammatical (i.e., P600, LAN) or lexical violations (i.e., N400). P600 is a positive shift of the waveform that happens around 600ms after the syntactic violation, left-anterior negativity (LAN) is a negative waveform 400ms after the syntactic violation and N400 is a negative shift after the semantic or lexical violation.

(13) a. Demain l'étudiant lira le livre.
Tomorrow the$_{\text{MASC}}$ student read$_{\text{FUT}}$ the book.
Tomorrow the student will read the book.
b. *Demain l'étudiant lisait le livre.
Tomorrow the$_{\text{MASC}}$ student read$_{\text{PRES}}$ the book.
Tomorrow the student read the book.

Steinhauer and Ullman (2002) conducted an ERP study on monolingual English speakers, using a similar material, i.e. sentences with temporal adverbials (e.g., *yesterday*) and a verb that matched (14a) or mismatched (14b) in English. While reading the sentences, monolinguals' brain responses were measured. The results of the temporal mismatches show changes through LAN (400–500 ms after the verb onset) and a positive-going wave form—a P600 effect (600 ms after the verb onset). The authors (Steinhauer & Ullman, 2002, p. 63) interpreted the findings as signaling the incremental use of temporal adverbial information seen in English monolinguals detecting the anomality when encountering a verb that mismatched in tense.

(14) a. Yesterday, I sailed Diane's boat to Boston.
b. *Yesterday, I sail Diane's boat to Boston.

A similar study by Baggio (2008), this time with 25 L1 Dutch speakers reading sentences in Dutch, obtained similar results (LAN—200-400 ms following the onset of the critical verb, and a P600-700 ms afterwards). However, the findings were interpreted by the author as semantic, not as morphological violations. Regardless of how the LANs are interpreted by researchers, native speakers seem to be sensitive to adverbial-tense mismatches.

In his study, Chan (2012) tested advanced L1 Korean, L1 Chinese and L1 German L2 learners of English on online morphosyntactic temporal violations. The study was three-fold, it investigated (i) if there were differences in speed between L1 and L2 speakers, (ii) if L2 learners could detect tense violations and (iii) if the L1 influenced the sensitivity during online processing. A word-by-word self-paced reading task included sentences with past simple and temporal adverbials used for past (15a and 15b) or future (15c), and progressive sentences with temporal adverbials in present (16a and 16b) or past (16c). So-called 'grammar-induced violations' were presented with a verb lacking an inflection for past tense (15b and 16b) and 'meaning-induced violations' included presenting a verb in a different tense compared to the temporal reference of the adverbial (15c and 16c) (Chan, 2012, p. 36).

(15) a. Past simple, well-formed
Yesterday several large snakes escaped from their cage at the zoo.
b. Past simple, grammar-induced violation
*Yesterday several large snakes escape from their cage at the zoo.
c. Past simple, meaning-induced violation
*Tomorrow several large snakes escaped from their cage at the zoo.

(16) a. Present progressive, well-formed
Currently the baby is laughing while the mother tickles him.
b. Present progressive, grammar-induced violation
*Currently the baby laughing while the mother tickles him.
c. Present progressive, meaning-induced violation
*Lately the baby is laughing while the mother tickles.

English monolinguals showed slowdowns for grammar-induced violations instantly, but only did so on the last segment for the meaning-induced violations. The L1 Korean group showed slowdowns for grammar-induced and meaning-induced violations that spilled over to segments after the verb in both past simple and progressive. The L1 German group detected grammar-induced violations in past simple and progressive, but showed no slowdowns for meaning-induced violations in the progressive. The L1 Chinese group was not sensitive to grammar-induced violations in the past. More precisely, the L1 German group was sensitive to grammar-induced violations (explained by a salient *–ing* form in past progressive) but not to meaning-induced violations in the progressive. On the other hand, the L1 Chinese group was not sensitive to grammar-induced violations in the past tense, and it was argued that the L1 influenced those results considering that Chinese does not grammaticalize tense. The results showed that English monolinguals and L1 Korean learners were sensitive to temporal violations in both past simple and progressive by showing slowdowns in RTs for grammar-and meaning-induced violations on almost all segments starting from the verb. Considering that the grammar of English (i.e., marking *–ed* for past and *–ing* for progressive) and the grammar of Korean (i.e., marking *–ess* for past and *–ko iss* for progressive) mark past and progressive quite similarly, the findings indicate that those learners whose L1s mark tense and aspect grammatically are able to detect meaning-induced and grammar-induced violations. The findings showed that L1 transfer is thereby responsible for the lack of slowdowns in detecting mismatches between the adverbial and the verb. In other words, the authors argue that, if the L1 lacks a grammatically encoded structure (e.g., aspect or tense), the learners will not be sensitive to L2-unique structures in real-time comprehension.

Roberts and Liszka (2013) also conducted a study on the incremental use of tense/aspect information in L2 English. The study hypothesized that if a learner has mastered the semantics behind the tense and aspect markings in the L2, the L2 learner will be able to detect online tense violations between the temporal adverbial and a verb (i.e., in past simple or present perfect). The participants tested were 20 British English native speakers, 20 adult L1 German learners of English and 20 adult French learners of English. The two L2 learner groups were tested and matched on their L2 proficiency and L2 knowledge of tense and aspect (via a cloze test). The participants were tested on their offline and online knowledge of matches and mismatches between the tense and the fronted temporal adverbial preceding it. An acceptability judgment tasked (AJT) used the same sentences in order to test their explicit knowledge on tense and aspect, while the self-paced reading (SPR) task looked at the incremental use of the same information. The participants were instructed to rate the sentences as least and most acceptable on a scale from 1 to 6 in the AJT. Sentences contained either verbs in past simple (17) or present perfect (18) tense with adverbials that matched (17a & 18a) or mismatched (17b & 18b) with the tense of the verb (Roberts & Liszka, 2013, p. 419).

(17) a. Past simple, match
Last week, James went swimming every day. Now he's getting bored of it.
b. Past simple, mismatch
*Since last week, James went swimming every day. Now he's getting bored of it.

(18) a. Present perfect, match

Since last week, James has gone swimming every day. Now he's getting bored of it.

b. Present perfect, mismatch

*Last week, James has gone swimming every day. Now he's getting bored of it.

The AJT found that all groups treated the match condition as more acceptable than the mismatch condition, regardless of the tense. However, the English native group seemed to rate the mismatch condition in the present perfect as less acceptable than the French and German. In a non-cumulative word-by-word SPR task, participants were presented with sentences, one word at a time in the middle of the screen. They were required to read sentences by pressing a button, which was later used as the information regarding how quickly the participants read the words. The experiment used 24 past simple and 24 present perfect items and 60 fillers. Based on the hypothesis, the prediction was that the L1 French group will show slowdowns in mismatch items due to the presence of grammaticalized aspect in their L1. On the other hand, because German lacks aspect that is grammatically encoded, the L1 German group will not be able to detect anomalies in the mismatch condition and, therefore, will show no differences between match and mismatch items. The results show that the L1 French group was overall slower at reading than the other two groups. When looking at past simple sentences, the verb region (*went*) and the region after the verb (*swimming*) showed no effects. However, the second region (Verb+2) after the verb (*every*) revealed longer RTs for mismatch than match sentences, but only for the French group. The analysis on present perfect showed that L2 French learners and English native speakers read the match condition faster than the mismatch condition on the word following the verb (Verb+1). The L1 German group did not show processing cost for tense mismatches in both past simple and present perfect tense during L2 real-time sentence comprehension. This led the researchers to conclude, that offline, all groups used the tense English information. The same results, however, were not visible for all groups in the SPR task. English native speakers, on the other hand, only showed processing costs in the present perfect condition. The authors (Roberts & Liszka, 2013) claim that only the learners of English whose L1 grammaticalized aspect are able to use the information incrementally while processing tense/aspect violation sentences (i.e., L1 French).

Eriksson (2016) looked at online processing of tense violations in native speakers of English and 24 advanced L1 Russian learners of English using an SPR task. Even though Russian has a perfective/imperfective distinction, it lacks a past tense that has a current relevance (i.e., present perfect). The study was an adaptation of the study by Roberts and Liszka (2013), but the study also manipulated verb classes based on lexical aspect (i.e., telic vs. atelic) and wanted to explore the effect of telicity on the sensitivity to online tense violations. Based on the Aspect Hypothesis (Andersen & Shirai, 1994), L1 Russian learners were expected to show slowdowns when processing present perfect sentences in an imperfective context (e.g., *every evening*) (Eriksson, 2016). The study used present perfect (24) and past simple (25) tenses, atelic (24ab & 25ab) and telic (24cd & 25cd) verbs, and the temporal adverbials either matched (24ac & 25ac) or mismatched (24bd & 25bd) with the tense of the verb (Eriksson, 2016, p. 8).

(19) a. Present Perfect: atelic, match
Since last year, Kate has studied French every evening.
b. Present Perfect: atelic, mismatch
*Last year, Kate has studied French every evening.
c. Present Perfect: telic, match
Since spring, Bert has planted many different flowers.
d. Present Perfect: telic, mismatch
*Last spring, Bert has planted many different flowers.

(20) a. Past Simple: atelic, match
Last year, Kate studied French every evening.
b. Past Simple: atelic, mismatch
*Since last year, Kate studied French every evening.
c. Past Simple: telic, match
Last spring, Bert planted many different flowers.
d. Past Simple: telic, mismatch
*Since spring, Bert planted many different flowers.

An AJT showed that monolingual English found the mismatch condition in present perfect unacceptable, but, in the past simple, they were not sensitive to mismatch items. The results of the native speakers have the same pattern as in Roberts and Liszka's study (2013), which was interpreted as native speakers accepting adverbials for present perfect because they denote an event that happened in the past. Regarding the SPR task, native English speakers were sensitive only to the present perfect mismatches. However, they were also more sensitive to mismatches with atelic verbs in present perfect and past simple. One of the explanations for that is that atelic verbs are not frequently used with completed past events (past simple and present perfect).

As for L2 learners, the AJT showed that the mismatch condition in present perfect and past simple was unacceptable. In the SPR task, L2 Russian learners were not sensitive to violations in either tenses, yet, similarly to the native speakers, telicity had an effect on the results (i.e. present perfect with atelic verbs was more difficult to process). Therefore, the study found native-like processing in the AJT for both groups and in the SPR for native speakers, showing that L2 learners can detect mismatches and that native speakers are more sensitive to past simple mismatches. L1 Russian learners did not show a sensitivity to online processing of adverbial-tense mismatches, which means that the presence of grammaticalized aspect did not guide the sensitivity to mismatches in online processing. The results do not support the findings of the study by Roberts and Liszka (2013).

O'Reilly (2018) aimed at replicating the study by Robers and Liszka (2013) but this time with L2 English learners that had a different L1, and with the addition of present simple mismatches. In her study, English native speakers, L1 Mandarin L2 English and L1 Croatian L2 English learners were tested. In a grammaticality judgement task (GJT), the results of the past simple items revealed that there was an interaction of group and condition. The results showed that L1 Croatian group was less sensitive to the mismatch conditions than the L1 English and L1 Mandarin group. In present perfect, all groups were sensitive to mismatches. Therefore, the participants displayed explicit knowledge of tense and aspect in English. The SPR task was the same as in Roberts & Liszka (2013), with an addition of the present simple tense items. The study also looked at six areas of interest, which extended the spillover region for analysis. The present simple items did not show any slowdowns in either condition for any group (including native speakers), which suggests that the groups did not use their explicit knowledge of present simple incrementally during online sentence processing. The same results were obtained for the present perfect and past simple items, with no significant differences between match and mismatch conditions detected.

3.4.1. Methodological issues.

Studies so far have have found conflicting evidence, yet another issue that was discussed in some studies was the topic of methodology. In her study, O'Reilly (2018) claimed that outlier correction of the SPR method has not been standardized, and also that it is questionable if the method tested implicit knowledge. In another study on adverbial-tense mismatches, Hopp (2020) tested effects of implicit training of aspect in English in a pre- and post-self-paced reading test with 64 intermediate L1 German L2 English learners. The study analyzed if the increased L2 exposure affects the sensitivity of tense mismatches. The learners were divided into an experimental group (which received implicit training) and a control group (exposure only to matching of the adverbial to past tense). The participants were presented with a cloze test and an AJT as offline measures, and with a SPR task as an online measure. In the cloze task and the AJT task, the results of the groups did not differ. However, in the AJT, both groups were more accurate when rating mismatches in present perfect than mismatches in past simple. The results of the SPR task showed that there was no difference between the pre-test and the post-test for past simple items in the control group, however, the experimental group showed longer RTs for mismatch items on the Verb+1 segment on the post-test. The analysis on present perfect items showed no difference between results on the pre-test and the post-test for both groups. Therefore, the L1 German group showed emerging sensitivity in the post-test to past simple mismatches. One of the possible explanations for the lack of sensitivity for present perfect mismatches is due to the fact that adverbials denoting a completed event are allowed with German present perfect (i.e., *Perfekt*) (Rothstein, 2008).

3.4.2. Summary.

In sum, online ERP studies with monolinguals show a clear incremental use of tense in adverb-verb tense agreement violations (Baggio, 2008; Steinhauer & Ullman, 2002). A study by Chan (2012) found L1 effects, with L1 Chinese learners of English not being able to detect past tense violations due to the absence of grammaticalized aspect in their L1. Roberts and Liszka (2013) argued in their study that only those learners whose L1s have grammaticalized aspect will be sensitive to tense agreement violations. However, other studies (Eriksson, 2016; O'Reilly, 2018) did not replicate Roberts and Liszka's (2013) results. Eriksson (2016) found that L1 Russian L2 English learners were not sensitive to offline nor online mismatches, indicating that the grammaticalized perfective/imperfective aspectual distinction was not a prerequisite for the incremental use of L2 tense. In her dissertation, O'Reilly (2018) found that L1 and L2 English speakers were sensitive to mismatches in the GJT, but the sensitivity to violations was not present with L2 learners nor English monolinguals during online sentence processing (contrary to L1 ERP studies). Finally, the study by Hopp (2020) suggested that even if L2 learners were not able to use L2 tense information online, implicit learning of the grammatical feature can lead L2 learners to slowly start using L2 tense incrementally.

The next section will discuss crosslinguistic differences between L1s relevant to the study at hand. Studies so far have focused on one or two languages with different tense or aspect systems, yet, what the research lacks is the systematic manipulation of those differences in order to tease apart possible factors for the co-activation of the L1 in the L2. Thus, in the next section, the L1s used in this study will be contrasted and the implications of those differences will be presented briefly before Study 2 is presented.

3.5. Crosslinguistic Differences in Tense and Aspect

In order to disentangle the L1 effects of grammatical encoding of tense and aspect, the current study will look at languages that differ in their realization of tense, aspect and present perfect tense. Table 51 shows that all three features are present in L2 English, but the L1s have a different degree of overlap with English. For example, German grammaticalizes tense, but lacks morphological means to mark aspect, and it lacks a tense that is an equivalent to English present perfect tense in form and meaning. L1 Croatian grammaticalizes tense and aspect, but again, similarly to German, lacks present perfect tense that conveys the same meaning as in English. Spanish, on the other hand, overlaps with English on all levels (i.e., tense, aspect and present perfect tense). By choosing these L1 languages, the study aims at disentangling which factor is the leading the sensitivity to temporal mismatches during online reading of L2 English. In the following, the encoding of tense and aspect will be discussed regarding the L1s used in the current study, namely, German, Croatian and Spanish.

Table 51. Crosslinguistic differences between L1s (German, Croatian and Spanish) and L2 English regarding tense and aspect

	English	German	Croatian	Spanish
Grammatical tense	+	+	+	+
Present perfect	+	–	–	+
Grammatical aspect	+	–	+	+

3.5.1. German tense and aspect.

German marks tense grammatically (i.e., with morphological marking on the verb). Tense is marked morphologically only in the past and present. For actions happening in the past *Perfekt* and *Präteritum* are used, and for present events *Präsens* is used. In this section, I will mostly focus on past tenses in more detail, since my study looks at tenses expressing past events in English (i.e., past simple and present perfect).

Präteritum is a simple tense which refers to a past completed even (before the time of the utterance) which does not relate the event to any other tense (Jespersen, 1996, p. 141). According to Fuchs et al. (2016, p. 139) it is used more frequently in written language (21). Its use in spoken speech is uncommon, except for a short list of verbs (i.e., 'to be' - *sein*, 'to have' - *haben*, 'to become' - *werden*, 'to know' - *wissen*, 'to give' - *geben* and modal verbs), as it could be seen in example (22). The two past tenses are used interchangeably and they are comparable in form with English present perfect (with *Perfekt*) and English past simple (with *Präteritum*). Yet, the use of temporal adverbials like *since* are incorrect with *Präteritum* because it expresses a specific point in time in the past.

(21) Es war einmal eine junge Frau mit dem Namen Alice.
It be$_{\text{PRÄT}}$ once one young woman with the name Alice.
Once upon a time, there was a young lady named Alice.

(22) Die Strecke war fantastisch und ich hatte tolles Wetter.
The route be$_{\text{PRÄT}}$ fantastic and I have$_{\text{PRÄT}}$ great weather.
The route was fantastic and I had a great weather.

Perfekt in German is similar in form to present perfect in English, however, *Perfekt* has only two uses: resultative and narrative (König & Gast, 2007). The resultative use refers to the result of a past event at the time of the utterance (23) or to an event that will happen in the future (24) (König & Gast, 2007, p. 300). As for the narrative use, it is used in the same way as *Präteritum*, i.e. past event before the moment of the utterance (25). However, the two tenses in English (past simple and present perfect) cannot be used interchangeably because only present perfect is used to narrate past events with current relevance.

(23) Stefan hat das Handy vergessen.
Stefan have$_{\text{PRES}}$ the cell phone forget$_{\text{PART}}$.
Stefan forgot the cell phone.

(24) Bis nächste Woche hat sie das bestimmt wieder vergessen.
Until next week have$_{\text{PRES}}$ she that definitely again forget$_{\text{PART}}$.
She will have definitely forgotten it by next week.

(25) Der Pilot hat das Flugzeug um drei gelandet.
The pilot have$_{\text{PRES}}$ the airplane at three land$_{\text{PART}}$.
The pilot landed the airplane at three o'clock.

In German, if the speaker wants to express the action that goes on until the time of the utterance (i.e., present perfect in English), *Präsens* would be used, because *Perfekt* would indicate the event that was finished before the time of the utterance (Dürich, 2005). *Perfekt* or *Pretäritum* both refer to completed actions in the past before the moment of utterance, they can be used with adverbials that denote the past, such as 'yesterday' (*gestern*) in (26a) and 'last week' (*letzte Woche*) in (26b). In contrast to English, adverbs that refer to a specified (*last month*) or unspecified point (*since last month*) in time can be used with *Perfekt* in German (Fuchs et al., 2016).

(26) a. Gestern hat Nicolas sein Büro aufgeräumt
Yesterday has Nicolas his office tidied$_{\text{PART}}$.
Yesterday Nicolas tidied his office.

b. Gestern räumte Nicolas sein Büro auf.
Yesterday tidy$_{\text{PRÄT}}$ Nicolas his office up.
Yesterday Nicolas tidied his office.

As already mentioned before, aspect is not grammatically encoded in German, which means that the language does not distinguish between imperfective and perfective nor simple and progressive. Lexical means are employed to express aspectual differences, such as 'at the moment' (*gerade*), 'now' (*jetzt*) and 'still' (*noch*) (27). Comrie (1976) points out that the difference between simple and progressive aspect can also be captured periphrastically. For example, a grammatical form such as *am* plus infinitive *sein* ('to be') express progressiveness (28).

(27) Jetzt kommt er zurück
Now come$_{\text{PRES}}$ he back.
He is coming back now.

(28) Ich bin am Arbeiten.
I be$_{\text{PRES}}$ on work.
I am working.

3.5.2. Croatian tense and aspect.

Croatian is a language that marks tense and aspect morphologically on the verb. Similarly to German, it has a richer inflectional morphology than English. In Croatian, an affix can contain information about person, number, tense and gender (among other types of information). In Croatian, tense is grammatically encoded in past and present, and the language locates events in past, present and future on a timeline. For events in the past, it uses *perfekt*, for events in the present *prezent* is used, and for events set in the future *futur I* is used. Example in (29) is *perfekt* tense, (30) shows *prezent* and (31) illustrates *futur I* (verb *want* in present tense + main verb in the infinitive). The following section will describe past tenses in Croatian in more detail and how they contrast with English past tenses.

(29) Dragan je pročitao knjigu prošlog tjedna.
Dragan be$_{\text{PREZ}}$ read$_{\text{PART}}$ book last week.
Dragan read a book last week.

(30) Dragan čita knjigu danas.
Dragan read$_{\text{PREZ}}$ book today.
Dragan reads a book today.

(31) Dragan će pročitati knjigu sutra.
Dragan want$_{PREZ}$ read$_{INF}$ book tomorrow.
Dragan will read a book tomorrow.

Croatian only uses one tense to refer to a past event that is similar in form to present perfect and encodes past simple completed-event meaning. *Perfekt* is a compound past tense composed of the verb ‘to be’ (*biti*) in present simple and a lexical verb in the past participle. The meaning that is encoded in *perfekt* is a past event that has an endpoint. Therefore, *perfekt* encodes past meaning, but where present perfect in English has an additional meaning of past event with current relevance, Croatian allows the use of present tense—*prezent* (O’Reilly, 2018). This is because there is no direct equivalent to present perfect in Croatian, and the closest tense to the current relevance is the tense that expresses the present (Barić et al., 1997).

Croatian differs from English and German in terms of grammatical aspect. English has a simple/progressive distinction, in German, aspect is not grammatically realized, but Croatian (like other Slavic languages) encodes perfectivity (32a) and imperfectivity (32b & 33a) of an event by adding either prefixes or suffixes (Martinot, Andel, & Sunar, 2003). Even though Croatian distinguishes between perfective and imperfective aspect, habituality is not distinguished from progressiveness. In this sense, the imperfective aspect expresses habituality and progressiveness, which means that there is only one morphological to express both habitual and progressive aspect. The difference is expressed lexically, through adverbials like ‘every day’ (*svaki$_{ADJ}$ dan$_{NOUN}$*) for habituality (33b) (O’Reilly, 2018).

(32) a. Jelena je **pro**čitala knjigu.
Jelena be$_{PREZ}$ (finish) read$_{PART}$ book.
Jelena read a book.
b. Jelena je čitala knjigu.
Jelena be$_{PREZ}$ read$_{PART}$ book.
Jelena was reading a book.
(33) a. Romina je kuhala ručak.
Romina be$_{PREZ}$ cook$_{PART}$ lunch.
Romina was cooking lunch.

b. Romina je kuhala ručak svaki dan.
Romina be$_{PREZ}$ cook$_{PART}$ lunch every day.
Romina used to cook lunch every day.

To sum up, Croatian realizes both tense and aspect grammatically. Past, present and future tenses are grammaticalized, which means that there is an allocated tense for each point in time on a timeline - perfekt, prezent and futur I, respectively. However, only *perfekt* and *prezent* are morphologically realized. *Perfekt* is a compound past that is similar to present perfect in form, but encodes the same meaning as past simple – past completed event. Croatian does not have an equivalent tense to present perfect in meaning. It also realizes only the perfective/imperfective aspect distinction through prefixation and suffixation on verbs, but does not encode progressiveness separately from habituality.

3.5.3. Spanish tense and aspect.

Spanish encodes tense and aspect grammatically. The tenses can express events located in the future (*future perfecto simple* – (34a)), present (*presente simple* – (34b)), and the past tense (*pretérito simple* – (34c)) can be realized in various ways by combining tense with grammatical aspect (Montrul, 2009). The examples below (34) show that all three tenses are realizes morphologically through adding suffixes to the verb stem.

(34) a. Marina leerá el libro.
Marina read$_{FUT}$ the book.
Marina will read the book.
b. Marina lee el libro.
Marina read$_{PRES}$ the book.
Marina read the book.
c. Marina leyó el libro.
Marina read$_{PRET}$ the book.
Marina read the book.

Spanish has a very similar tense system to the English system, in that it uses *pretérito perfecto simple* to denote actions that happened in the past (35a), but also it uses *pretérito perfecto compuesto* (35b) to refer to events with current relevance (Montrul, 2004). *Pretérito perfecto compuesto* consist of the verb ‘to have’ (*haber*) and past participle of the main verb. The past participle in Spanish for regular verbs is constructed by adding endings −*ado* or −i*do* (depending if the verb ends in −*ar* or −*er*/−*ir*). However, there are also irregular verbs that do not comply to the rules (e.g., *escrito* – 'written'). Similarly to the present perfect in English, *pretérito perfecto compuesto* uses the same meaning of current reference (Dahl & Hedin, 2008). It can also convey a resultative, experiential, recent past and continuative meaning.

(35) a. Marco vio su novia.
Marco see$_{\text{PRET}}$ his girlfriend.
Marco saw his girlfriend.

b. Marco ha visto su novia.
Marco have$_{\text{PRES}}$ see$_{\text{PART}}$ his girlfriend.
Marco has seen his girlfriend.

Spanish also grammaticalizes aspect, in that it differentiates between perfective and imperfective aspect. Preterit (*pretérito perfecto simple*) and imperfect (*pretérito imperfecto simple*) in the past are labelled morphologically by adding inflectional suffixes to the verb, and aside from signaling past events, they also signal aspect (36a & 36b). *Pretérito perfecto*, similarly to English past simple, is a simple tense signaling past completed events. *Pretérito imperfecto* is used for progressive and habitual events in the past. In Spanish, the telicity of verbs does not restrict which verb could be used with which tense, as all can be expressed in preterit and imperfect (Montrul, 2004).

(36) a. Jennifer trabajó en la escuela.
Jennifer worked$_{\text{PRET}}$ in a school.
Jennifer worked in a school.

b. Jennifer trabajaba en la escuela.
Jennifer worked$_{\text{IMPERF}}$ in a school.
Jennifer was working/used to work in a school.

Pretérito perfecto simple signals a past completed event (perfective aspect), while *pretérito imperfecto simple* signals imperfectivity (Montrul, 2009). Incompletion (i.e., imperfectivity) can be expressed through habitual (37a), intention (37b), generic (37c) or progressive (37d) meaning (Montrul, 2004).

(37) a. Cuando era pequeño jugaba con mi hermano.
When was$_{\text{IMPERF}}$ little played$_{\text{IMPERF}}$ with my brother.
When I was younger I used to play with my brother.
b. Estudiaba para el examen pero me enfermé.
Study$_{\text{IMPERF}}$ for the exam but me got sick.
I studied for the exam, but I got sick.
c. Las mujeres no trabajaban en el siglo XVI.
The women no work$_{\text{IMPERF}}$ in the century XVI.
Women did not work in the XVI century.
d. Bailaba en la disco cuando recibí una llamada.
Dance$_{\text{IMPERF}}$ in the disco when got$_{\text{IMPERF}}$ a call.
I was dancing in the disco when I got a call.

Spanish can also express progressiveness through the combination of the verb *estar* ('to be') in *pretérito imperfecto simple* tense + the gerund (38) (Montrul, 2004).

(38) Estaba bailando en la disco cuando recibí una llamada.
Be$_{\text{IMPERF}}$ dance$_{\text{PRET}}$ in the disco when got$_{\text{IMPERF}}$ a call.
I was dancing in the disco when I got a call.

In conclusion, Spanish is the closest out of all L1s in this study to English in terms of tense and aspect morphological encoding. Regarding tense, *pretérito perfecto simple* has an equivalent meaning and form to English past simple, and *pretérito perfecto compuesto* is also comparable to present perfect on both form and meaning. When it comes to aspect, Spanish grammaticalizes the perfective/imperfective distinction, but also has an additional means for expressing progressiveness.

3.5.4. Summary

The L1s in for this study differ from each other and from English on various levels (Table 52). For instance, even though all languages realize tense grammatically, there is a difference between expressing past completed event (e.g., past simple in English) and past event with current relevance (e.g., present perfect in English) (Dahl & Hedin, 2008). All three L1s have means of expressing a past completed event (i.e., German – *Perfekt/Präteritum*, Croatian – *perfekt*; Spanish – *pretérito perfecto simple*), but not all of them have a compound tense that conveys the same meaning as English present perfect tense. Moreover, all languages except for German grammaticalize aspect, but they grammaticalize different distinctions.

Table 52. Crosslinguistic differences between L1s (German, Croatian and Spanish) and L2 English regarding tense and aspect

	English	German	Croatian	Spanish
Grammatical tense	+	+	+	+
Simple past	+	+	–	+
Compound past	+	+	+	+
Past tense with current relevance	+	–	–	+
Grammatical aspect	+	–	+	+
Perfective	+	–	+	+
Imperfective	–	–	+	+
Progressive	+	–	–	+

German and English do not completely overlap in the use of the tense, which is especially visible when comparing *Perfekt* and present perfect – past compound tenses that are similar in form, but differ in their use. In German, *Perfekt* is a compound tense that refers to a completed event. Aspect can be achieved through lexical means, for example, by using adverbials denoting time span (*seit gestern* – 'since yesterday'). Similarly to German, Croatian uses a compound tense *Perfekt* for past completed events. However, it grammaticalizes the imperfective/perfective distinction. Spanish has the most similar system to English tense and aspect, which means that it has two separate tenses to express past completed events that have no relevance to the present (*pretérito simple*) and those events that have current relevance (*pretérito perfecto compuesto*). In terms of aspect, it grammaticalizes both imperfective/perfective and simple/progressive distinction. This means that Spanish is the closest language to English in terms of tense and aspect realization.

The predictions of this study are the following. If the presence of grammaticalized aspect in the L1 is the prerequisite for L1 learners of English to use L2 information incrementally, only L1 Croatian and Spanish learners will display sensitivity to tense mismatches in L2. If the presence of English present perfect equivalent (in form and meaning) in L1 is the deciding factor, then L1 Spanish learners will show sensitivity to tense mismatches between the temporal adverbial and the tense marking of the verb. The following section summarizes crosslinguistic differences between languages and how the L1s compare to L2 English.

3.6. The Study: Coreference Agreement Violations

3.6.1. Overview and research questions.

The current study investigates online processing of L2 English tense by different L1 learners (i.e., German, Croatian and Spanish). It tests if the L1 (crosslinguistic differences) affects the processing of coreference agreement violations. The study is a replication of Roberts and Liszka (2013), however, applied to different L1 groups in order to analyze which factor determine the sensitivity to grammatical tense information in the L2. Roberts and Liszka (2013) tested if L1 (+/-) grammaticalized aspect affects the sensitivity to tense violations between the verb and the adverbial. The learners had French or German as their L1, and only those who had a formal marking of aspect in the L1 were able to detect tense mismatches in online processing, according to Roberts and Liszka (2013).

Based on the research done so far, studies on monolinguals using ERPs (Baggio, 2008; Steinhauer & Ullman, 2002) detected online sensitivity to tense mismatches, which could also be seen in studies on L2 processing using the SPR method (Chan, 2012; Roberts & Liszka, 2013). Roberts and Liszka (2013) claim that the presence of grammaticalized aspect in the L1 is a prerequisite for the sensitivity to mismatches between the verb tense and temporal adverbial. Chan (2012) argues that the grammatical realization of tense in L1 is a prerequisite to the incremental use of L2 tense. A replication of Roberts and Liszka (2013) found no sensitivity to mismatches for L1 nor L2 users (O'Reilly, 2018). Because the results of the study by O'Reilly (2018) were published only after analyzing the results of the current study, the reasons for choosing those specific L1s and asking the following research questions will be based on those studies done prior to my study, such as Chan's (2012) and Roberts and Liszka's (2013). Considering that studies so far claimed that different factors affect L2 sensitivity to temporal mismatches, the study at hand will use languages that differ or overlap on different linguistic aspects, so that the main factor can be detected. Those linguistic levels include: grammaticalized tense, grammaticalized aspect and present perfect (Table 53).

Table 53. Predictions for German, Croatian and Spanish L2 of English using tense, aspect and present perfect as main factors

	English	German	Croatian	Spanish
Grammatical tense	+	+	+	+
Present perfect tense	+	–	–	+
Grammatical aspect	+	–	+	+

Therefore, the study at hand broadens the question of L1 crosslinguistic influence by using L1 advanced learners of English whose L1s differ on tense, aspect and present perfect. These languages differ in their encoding of tense (past simple vs. present perfect) and aspect (imperfective/perfective vs. simple/progressive). These crosslinguistic differences will be key points in posing questions for my study. Moreover, the results of the experiment will be discussed in the context of the SSH (Clahsen & Felser, 2006), which argues for non-native sentences processing of morphosyntax, generative L2 acquisition models (Lardiere, 2009) claiming that L2 acquisition is a process of L1 feature reconfiguration, and usage-based models that argue for cue-blocking (Ellis & Sagarra, 2010b).

The following research questions are posed and the corresponding hypotheses are proposed:

Research question 1: Do learners of L2 English show sensitivity to tense mismatches between temporal adverbials and verbs in English in production?

Hypothesis 1: All learners will show sensitivity to tense mismatches between temporal adverbials and verbs in English in production.

Research question 2: Do learners of L2 English show sensitivity to tense mismatches between temporal adverbials and verbs in English in real-time sentence comprehension?

Hypothesis 2: Learners will differ in their sensitivity to tense mismatches between temporal adverbials and verbs in English in real-time sentence comprehension.

Research question 3: Does the presence or absence of grammaticalized aspect in L1 affect L2 English tense processing?

Hypothesis 3: L1 Croatian and L1 Spanish learners will show sensitivity to tense mismatches in real-time L2 because their L1 realizes aspect grammatically. L1 German learners will show no processing cost because the language lacks grammaticalized aspect.

Research question 4: Does the presence of L1 tense which matches in form and meaning to L2 present perfect affect L2 English processing of tense mismatches?

Hypothesis 4: L1 Spanish learners will show sensitivity to online tense mismatches between temporal adverbials and verbs because their L1 has a tense that overlaps in form and meaning with present perfect. L1 German and L1 Croatian learners will show no processing cost because the languages lack a compound tense that has a meaning of a past event with current relevance.

3.6.2. Participants.

Three groups of L2 English learners were tested: L1 German, L1 Croatian and L1 Spanish. Unfortunately, due to time constraints, English native speakers were not tested as a control group. However, considering that the materials, the method and the statistical analysis was completely adopted from Roberts and Liszka (2013), and the control group showed sensitivity to mismatches, I will assume that there is no reason to question that the control group in this study would not show the same results. All the participants in this study were tested in their respective countries and were all university students. There were 27 L1 German (M_{AGE} = 24.73, SD_{AGE} = 4.69, range: 19 – 37), 41 L1 Croatian (M_{AGE} = 21.83 years, SD_{AGE} = 2.1, range: 19 – 29 years) and 27 L1 Spanish (M_{AGE} = 24.81, SD_{AGE} = 3.83, range: 20 – 34) learners. The participants were tested in their home country and had an intermediate to advanced level of English proficiency. The study excluded early bilinguals, as that might have affected the results of the current study, this led to excluding one L1 German learner. Table 54 summarized the results of the language background questionnaire.

For language proficiency assessment, the learners were tested on their L2 English using a LexTALE (Lemhöfer & Broersma, 2012). Moreover, a category Fluency Task (CFT) (Delis et al., 2001) tested vocabulary production. All groups were tested by using LexTALE for their L2 English knowledge. The same test in German was administered to L1 German group in order to test their L1 knowledge. Two German learners, one Croatian learner and four Spanish learners of English were excluded because they performed at chance (below 60%) on English LexTALE.

The same LexTALE tasks like in Study 1 were used to test learners' L1 knowledge. The CFT (Delis et al., 2001) tested participants' productive vocabulary in their L1 and L2. The test was always introduced in the target language and it required participants to name as many items in the target language in one minute per category. In this case, two categories were chosen (i.e., animals and furniture), which means that the participants had one minute for each category. The results were recorded and later transcribed. Only those answers that related to the category were accepted as correct responses.

The participants were also screened based on how well they could distinguish between present simple, past simple and present perfect in the cloze test. Only those who scored above 60% were included in the main analysis. This means that eleven Croatian and three Spanish learners of English were excluded (more on the cloze test in Section 3.6.3.2). In the end, the L2 learner groups comprised of 24 L1 German (M_{AGE} = 25.08 years, SD_{AGE} = 4.16, range: 20 – 37 years) , 29 L1 Croatian (M_{AGE} = 21.93 years, SD_{AGE} = 2.33, range: 19 – 29 years) and 20 L1 Spanish (M_{AGE} = 24 years, SD_{AGE} = 3.16, range: 20 – 33 years) students. The L1 German group were students at the TU Braunschweig in Germany (10 male, 14 female), the L1 Croatian group were students at the University of Rijeka in Croatia (12 male, 17 female), and the L1 Spanish group were students at the University of Granada in Spain (7 male, 13 female). Sixteen L1 German, 29 L1 Croatian and 20 L1 Spanish learners of L2 English were the same as in Study 1 on grammatical gender. None of the students was an early bilingual, and they were all students of English Studies, with the exception of the participants in Spain. Due to the lack of students of English Studies in Spain that were willing to participate, every student (not necessarily an English major) who had good knowledge of the language was admitted as a potential candidate.

A language background questionnaire was administered to participants that asked questions about details such as their subjective ratings of English skills, years of learning and learning impairments. Because of a non-normal distribution of the data, a Kruskal–Wallis one-way analysis of variance was employed and it revealed a significant difference in the age of participants (H (2) = 11.82, p = .003). A non-parametric Mann-Whitney U test was employed in order to see where exactly the difference was, and it revealed significant difference between the L1 Croatian and L1 German (U = 174.0, p < .001), and the L1 Croatian and L1 Spanish groups (U = 165.5, p = .005). Therefore, the L1 Croatian group had a lower average of age than the other two groups. The age of acquisition also displayed differences between groups (H (2) = 18.52, p < .001), in that the L1 German group (M = 8.58, SD = 1.69, range: 5 – 12) started learning English later than the L1 Croatian (M = 6.21, SD = 2.38, range: 2 – 11) and L1 Spanish groups (M = 6.3, SD = 1.53, range: 3 – 9). Even though the groups started learning English at different points, the mean length of exposure was not any different among groups (H (2) = 4.12, p = .13).

Table 54. L2 learners' participant information and the results of between-group analyses (N = 73).

	L1 German (n = 24)			**L1 Croatian** (n = 29)			**L1 Spanish** (n = 20)			**Between-group analysis**
	Mean	Range	*SD*	Mean	Range	*SD*	Mean	Range	*SD*	
Age (in years)	25.08	20 – 37	4.16	21.93	19 – 29	2.33	24	20 – 33	3.16	H (2) = 11.82, p = **.003**
Age of acquisition (in years)	8.58	5 – 12	1.69	6.21	2 – 11	2.38	6.3	3 – 9	1.53	H (2) = 18.52, p < **.001**
Years of learning L2	13.29	7 – 22	3.45	15.07	9 – 23	3.03	14.45	2 – 20	4.45	H (2) = 4.12, p = .13
English LexTALE (score/max 100)	83.11	68.75 – 97.5	9.19	86.25	71.25 – 97.5	7.36	72.56	62.5 – 86.25	6.25	H (2) = 25.75, p < **.001**
L1 LexTALE (score/max 100)	92.74	83.25 – 100	4.78	93.06	68.75 – 100	7.89	94.37	84.83 – 100	4.18	-
English CFT (words/minute)	33.38	24 – 45	6.09	35.07	22 – 51	7.01	33.35	22 – 47	8.19	F (2, 70) = 0.51, p = .60
L1 CFT (words/minute)	45.13	29 – 66	10.02	43.14	31 – 55	6.7	48.45	29 – 70	11.4	-

In order to eliminate participants who scored at chance on English LexTALE, only those who scored above 60% were considered for the study. For all remaining participants, the English LexTALE revealed that L1 learners of English differ in their scores (H (2) = 25.75, p < **.001**). More precisely, the L1 Spanish group (M = 72.56, SD = 6.25, range: 62.5 – 86.25) scored lower on the test than their L1 German (M = 83.11, SD = 9.19, range: 68.75 – 97.5) or L1 Croatian (M = 86.25, SD = 7.36, range: 71.25 – 97.5) peers, which was shown by using the Mann-Whitney U test and comparing Spanish-German (U = 84.5, p < **.001**) and Spanish-Croatian (U = 49.0, p < **.001**) groups. A one-way ANOVA showed that there were no differences between groups for the CFT (F (2, 70) = 0.51, p = .60). LexTALE will be included in the model in order to make sure that all the possible factors are accounted for.

The language proficiency of the L1 was also assessed by the same tests (i.e., LexTALE and CFT). L1 German learners had an average of 92.74 points on German LexTALE (SD = , range: 83.25 – 100) and 45.13 on the CFT in German (SD = 10.02, range: 29 – 66); L1 Croatian learners had 93.06 on Croatian LexTALE (SD = 7.89, range: 68.75 – 100) and 43.14 on the CFT in Croatian (SD = 6.7, range: 31 – 55); and L1 Spanish scored 94.37 on LexTALE (SD = 4.18, range: 84.83 – 100) and 48.45 on the CFT in Spanish (SD = 11.4, range: 29 – 70). The results for both LexTALE and the CFT show that L2 learners performed at ceiling in their L1.

3.6.3. Materials.

3.6.3.1. Main experiment.

The study used the SPR task in order to tap into L2 learners' online use of English tense and aspect. Considering that the aim of the study is to replicate Roberts and Liszka's (2013) study on tense and aspect, the same materials were used. This led to 24 experimental items in four conditions, distributed equally in four lists, and 80 fillers.

The experimental items for the present study consisted of two sentences each, first a sentence with a sentence-initial adverbial and the verb in past simple or present perfect and a follow-up general sentence connected to the main one (see (39) and (40)). The experiment had four conditions in a 2x2 design, namely, Tense (past simple vs. present perfect) and Type (match vs. mismatch). The critical sentence always introduced the temporal adverbial, which was in the topic position. The temporal features of the adverb indicated which tense the rest of the sentence should use: the past simple tense (i.e., *last week*) or present perfect tense (*since last week*). In the case where the temporal features of the verb did not match with the features of the adverbial, these items were called 'mismatch' items (39b, 40b), and if the temporal features matched the temporal cue of the adverbial, then they were called 'match' items (39a, 40a). An example of the sentences in past simple (39) and present perfect (40) is given below.

(39) a. Past simple, Match
Last month, Sarah felt unhappy at work. She even thought about leaving.
b. Past simple, Mismatch
Since last month, Sarah felt unhappy at work. She even thought about leaving.

(40) a. Present perfect, Match
Since last month, Sarah has felt unhappy at work. She even thought about leaving.
b. Present perfect, Mismatch
Last month, Sarah has felt unhappy at work. She even thought about leaving.

Out of eighty fillers, a portion of them (20 sentences) were experimental items for Study 3 in this thesis which looked at the processing of temporarily ambiguous sentences during early and late closure in past simple and past progressive (see Chapter 4). Moreover, sixty additional filler items comprised two sentences that referred to the past event. A clausal coordination was introduced in the sentences and they were subject initial (.e.g., *Because the audience did not laugh at any of his jokes, the comedian left the stage. This was a sad day for him.*). Twenty filler items (that were experimental items for Study 3 in Chapter 4) and 20 filler items were followed by a yes/no comprehension question. The experimental items used for Study 2 can be found in Appendix B.

3.6.3.2. Control experiments.

Aside from the main experiment, the control experiments consisted of the cloze test and the AJT. The offline cloze test aimed at testing the participants' knowledge of tense and aspect in English by distinguishing between the present simple, past simple and the present perfect. It consisted of 30 isolated sentences that were presented with gaps, in which the participants were expected to use a verb given in the bare form and inflect it according to person, number and tense. Each sentence was either in present simple, past simple or present perfect tense. An example of the cloze test is presented below (41).

(41) Adam's eyes were closed, so Jill _________________ (think) he was asleep. But he wasn't!

The cloze test in groups' L1s was constructed based on the cloze test in English (Appendix B). There were 30 items with gaps that had to be filled in with the correct verb. The aim of having a cloze test in the L1 is to see if the learners are consistent in the use of tenses and if they have a tendency to use one tense over the other in the present perfect compared to the past simple example. Considering that the threshold in the study by Roberts and Liszka (2013) was 60% of the overall cloze test score for the SPR, only those participants that scored above 60% were considered for the study, in order to avoid scores on tense and aspect that are at chance. The instructions were always in their L1. The items were not translated from English, but followed the same sentence pattern in German, Croatian and Spanish. Because there is an equivalent tense to English *present perfect* in Spanish that encompasses tense and aspect, the solutions in Spanish should be the similar to the solutions in English. That means that the correct solution for the L1 Spanish cloze test would be 10 *presente simple* (for present simple), 10 *pretérito perfecto simple* (for past simple) and 10 *pretérito perfecto compuesto* (for present perfect) items. Because German and Croatian do not have the conceptual meaning of a present perfect tense, only the form of present perfect, the test investigated what the participants' strategy in this case would be.

Another offline task that was administered was an AJT which looked at the tense/aspect agreement violations with the temporal adverbial. The task was only administered in English. In contrast to the SPR, the AJT aimed at exploring the participants' offline knowledge of tense and aspect. The twenty-four items used for the task were twelve fillers and twelve experimental items (6 past simple and 6 present perfect items from the SPR task). This means that out of twelve experimental items, there were three items per condition, leading to six grammatically correct and six grammatically incorrect sentences. Similarly to the experimental items, half of the fillers were grammatical and half ungrammatical. The participants were required to label the sentences as correct or incorrect (Appendix B). Only if the error was underlined in the sentence was the answer accepted.

3.6.4. Procedure.

3.6.4.1. Main experiment.

In a non-cumulative Moving Windows SPR task, the participants were required to read sentences presented word-by-word on the screen and they were instructed to press the button whenever they want to read the next word. This means that individual speed varied, depending on how fast they wanted to advance. The details on the procedure during SPR will follow in Section 3.6.4.1.

The participants first completed the main SPR experiment which was administered in E-Prime (Schneider et al., 2002) on a laptop with a 15.6" display. The participants were seated around 60cm away from the laptop. The task always started with instructions followed by a trial of the main experiment, which consisted of four sentences followed by yes/no questions, so that there was no confusion about what the participants were required to do in the SPR task. The instructions were given in English orally and in writing. The participants were instructed to read the sentences at their own pace by pressing the space button. Before and after each sentence, a white cross was presented in the middle of the screen indicating the end or the beginning of a new item. That time was also used by some to rest if the participants thought they needed a break. Following the white cross, a word would a appear, which would disappear when the participants clicked the button, and was replaced by the following word in a sentence only when they pressed the button. A full stop indicated the end of the sentence, and it was always presented right next to the final word (as in writing). After each experimental item, the participants were presented by a yes/no question (*Did Sandra think about quitting her job?*) which they should answer by pressing a button on the keyboard designated for ‘yes’ or a button designated for ‘no’. The comprehension questions always referred to the truthfulness of the first or the second sentence. The experiment lasted for approximately 30 minutes.

3.6.4.2. Control experiments.

Both the English and the L1 cloze test had the same number of items and the same instructions. The participants were expected to fill in the gaps with the verbs in parentheses in the appropriate tense form in a paper-and-pen task. Each sentence stood for itself, and some of them had to have an additional clause in order to provide the context. Out of 30 possible answers, the correct answers were divided equally across tenses (i.e., 10 for present simple, 10 for past simple and 10 for present perfect). The results were transformed into percentages in the results section.

The order of the experiments was the following: the main experiment was always given at the beginning. This was later followed by the acceptability judgement task and the cloze task in English. After doing the proficiency tasks in English and filling in the questionnaire, the participants had to do the same experiments in their L1. In this part, all the instructions were given in their L1. The participants started with the cloze test and finished with the proficiency tasks. The results of the control experiments and the SPR task will be discussed in the following section.

3.6.5. Results.

3.6.5.1. Control experiments.

The English cloze test was used as a selection criterion for the main experiment. The participants could have a maximum of 30 points (10 for present simple, 10 for past simple and 10 for present perfect) which were later transformed into percentages. Only those students that scored higher than 60% were included in the analysis in order to make sure that the results were above chance. If there was a spelling mistake, e.g. using third person 'has' instead of 'have', the answer was accepted as correct. This was also applied if the irregular verbs were inflected with the regular *–ed* ending and if the first person *–s* was omitted in the present simple. After eliminating eleven Croatian and three Spanish learners who scored below 60%, the rest of the participants all scored above 63% with the following means: L1 German 80% (SD = 13.17, range: 63% – 100%), L1 Croatian 90% (SD = 6.58, range: 73% – 100%) and L1 Spanish 88% (SD = 13.17, range: 73% – 100%). A Kruskal-Wallis analysis of variance revealed differences between L1 groups (H (2) = 7.61, p = .02). Mann-Whitney U tests showed that the L1 German group scored lower than the L1 Croatian (U = 203.0, p = **.004**) and L1 Spanish group (U = 154.5, p = **.02**). No difference was found between the L1 Croatian and L1 group learners (U = 267.0, p = .32).

Because the cloze test also included present simple which was not of interest for the current study, the results of the test without the present simple were analyzed separately. L1 German learners had a mean of 71.25% (SD = 19.8, range: 45 – 100), L1 Croatian 86.38% (SD = 9.99, range: 60 – 100) and L1 Spanish 83% (SD = 14.36, range: 50 – 100). A one-way analysis of variance revealed differences between groups (H (2) = 7.54, p = **.02**), which was seen between the L1 German and L1 Croatian group (*U* = 204.0, *p* = **.004**), and L1 German and L1 Spanish group (*U* = 156.5, *p* = **.02**). There was no significant difference between the L1 Croatian and the L1 Spanish group (*U* = 259.5, *p* = .27). The results have the same pattern as the results of the cloze test including the present simple items. Table 55 summarizes the results for the cloze test and cloze test without the present simple items.

Table 55. The results of L1 groups for the acceptability judgement task, cloze test and cloze test without the present simple items (-PrS); between-group analyses results for each task.

		Cloze test	Cloze test (-PrS)
German	M	80%	71%
(*n* =24)	SD	13.17	19.8
	Range	63% – 100%	45% – 100%
Croatian	M	90%	86%
(*n* =29)	SD	6.58	9.99
	Range	73% – 100%	60% – 100%
Spanish	M	88%	83%
(*n* = 20)	SD	13.17	14.36
	Range	73% – 100%	50% – 100%
Between-group analysis		*H* (2) = 7.61, *p* = .02	*H* (2) = 7.54, *p* = .02

A Pearson correlation was run on English proficiency (LexTALE) and the knowledge of tense and aspect (English cloze test). The correlation test aimed at looking if the higher English proficiency leads to a better understanding of the use of English tense/aspect distinctions. The correlation was not done by-group, but was run on the results of all groups combined, and it revealed no correlation between the tests (*r* (73) < .004, *t* = 0.15, *p* < .88) (Figure 39).

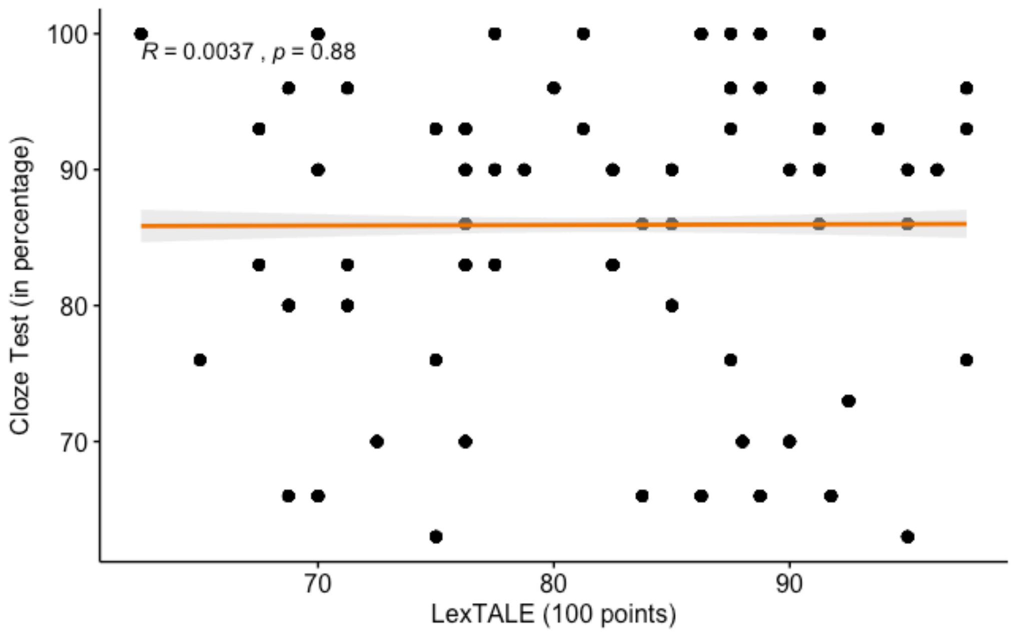

Figure 39. The correlation of the L2 learners' English proficiency (max 100 points) and cloze test (in percentages) results ($N = 73$).

In the AJT the highest accuracy score was 3 per condition. The results of the grammaticality for the past simple items are in Table 56 and for the present perfect items in Table 57 per group and per condition.

Table 56. L2 learners' acceptability judgments: past simple (SD is given in parentheses).

Tense	Match	Mismatch
L1 German	2.46 (0.66)	1.13 (0.99)
L1 Croatian	2.59 (0.63)	1.03 (1.02)
L1 Spanish	2.4 (0.6)	1.2 (0.7)

Table 57. L2 learners' acceptability judgments: present perfect (SD is given in parentheses).

Tense	Match	Mismatch
L1 German	2.29 (0.75)	2.08 (0.88)
L1 Croatian	2.45 (0.74)	1.97 (1.12)
L1 Spanish	2.45 (0.83)	1.9 (1.02)

A linear mixed effects model was run on the scores of all three groups with Tense, Type and Group as fixed factors, Participants and Items as random intercepts and Tense and Type as random slopes. Tense referred to past simple vs. present perfect; Type to match vs. mismatch; Group to L1 German, L1 Croatian and L1 Spanish; and Proficiency was the LexTALE score. A *lmer* function in *lme4* package (Bates et al., 2015) was adopted for the analysis in *R Studio Version 3.4.3* (R Core Team, 2017). I used treatment coding, i.e. the L1 German group was used as a baseline for group comparison. This was done because the study at hand predicts differences between the L1 German group and other L1 groups, as only German does not grammaticalize aspect.

Table 56 and 57 show that learners were better at detecting match conditions in both past simple and present perfect, even though they still did not perform at ceiling. However, the learners were not native-like in detecting mismatch conditions in both tenses. In all three L1 groups, the learners especially scored low on detecting present perfect mismatch items as an incorrect choice for the temporal adverbial used for past simple. Yet, the scores for past simple mismatch are still incorrectly interpreted as correct. In the continuation, the results of the model on the AJT will be outlined.

Table 58. Output from linear-mixed effects models run on AJT scores for all groups ($N = 73$). The fixed factors included: Group (German, Croatian and Spanish), Tense (Past simple vs. Present Perfect) and Type (match vs. mismatch).

	Estimate	SE	*t*-value	*p*-value
(Intercept)	2.29	0.16	14.58	< .001
GroupCroatian	0.16	0.21	0.74	.46
GroupSpanish	0.16	0.23	0.68	.50
Tense	0.17	0.22	0.77	.44
Type	-0.21	0.27	-0.78	.44
GroupCroatian*Tense	-0.03	0.29	-0.10	.92
GroupSpanish*Tense	-0.22	0.32	-0.68	.50
GroupCroatian*Type	-0.27	0.36	-0.76	.45
GroupSpanish*Type	-0.34	0.40	-0.86	.39
Tense*Type	-1.13	0.30	-3.71	**.001**
GroupCroatian*Tense*Type	0.06	0.41	0.14	.89
GroupSpanish*Tense*Type	0.48	0.45	1.06	.29

Formula in R: *Scores ~ Group*Tense*Type + (1+Tense*Type|Participant) + (1+Tense*Type|Item)*

The linear mixed effects model did not reveal any main effects (Table 58), however, there was an interaction found between Tense and Type which was visible in lower accuracy scores for present perfect mismatch items. This means that learners were not sensitive in detecting the mismatch between the temporal adverbial used for past simple (e.g., *yesterday*) and a verb in present perfect (e.g., *has felt*). This leads me to conclude that the lower accuracy scores for mismatch items in present perfect show variability in learners' knowledge of tenses, which is not target-like.

3.6.5.2. Main experiment.

The main experiment was a self-paced reading task and it measured incremental processing of tense and aspect on reading times (RTs) of the critical segments. The RTs were cleaned from outliers that were more than two standard deviations away from the mean for each participant. The values that fell outside the set borders were replaced by the participant's mean RT. Furthermore, only if the comprehension questions were answered correctly were the items analyzed. L1 German learners had an accuracy mean of 95% (*SD* = 21.52), L1 Croatian patterned similarly with a mean of 94% (*SD* = 22.73), and L1 Spanish had a slightly lower mean of 91% (*SD* = 27.67). The accuracy scores were compared by using a One-Way ANOVA that revealed marginal differences between groups (F (2, 1749) = 3.14, p = **.04**). The differences were analyzed by using independent samples t-test, and a difference was found between German and Spanish (t (1054) = 2.29, p = **.02**) and marginally between Spanish and Croatian (t (1174) = 1.95, p = **.05**). L1 German and L1 Croatian learners patterned similarly in their results on accuracy (t (1270) = 0.48, p = .60). Therefore, the tests confirm that the Spanish group had marginally significantly more incorrect answers for the experimental items than the other L1 groups, and the results were more significant when the L1 Spanish group was compared to the L1 German group.

After outlier correction and accuracy analysis, a linear regression model, i.e. *lmer* function in *lme4* package (Bates et al., 2015) was used to test the incremental use of L2 English aspectual difference. Two analyses were done in *R Studio Version 3.4.3* (R Core Team, 2017) on tenses separately (past simple vs. present perfect). The analysis was done in the same way as in Roberts and Liszka (2013). The linear mixed effects model for both tenses had Group, Type and AJT as fixed factors. Participant and Item were added as random intercepts with Type as a random slope for both random factors. The factor Group referred to L1 German, L1 Croatian and L1 Spanish; Type to match vs. mismatch; and AJT score was used as a measure of awareness regarding tense and aspect in English. Because Proficiency and Cloze Test did not have an effect on any segment when running the model, they were removed.

As in Roberts and Liszka (2013), the analysis was run on raw reading times on past simple (Table 59) and present perfect items (Table 64) on four segments (i.e., *Verb*, *Verb+1*, *Verb+2*, *Verb+3*). For example, in the sentence *Last month, Sarah felt unhappy at work*, the *Verb* segment referred to the first verb (*felt*) after the subject. The following three segments were also analyzed in order to catch the potential spillover effects. Therefore, the separate analyses on past simple and present perfect are trying to find Type and Group interactions, however, the sensitivity of agreement irregularities should only be detectable in the case of

L1 Croatian and L1 Spanish learners. Therefore, the model is trying to find differences between L1 German learners and L1 Croatian and Spanish learners.

3.6.5.2.1. Omnibus analysis: past simple.

Table 59 lists mean reading times on critical segments for match and mismatch items per group for sentences with past tense verbs. Figure 40 visualizes the relative processing cost, which means that the mismatch condition had been subtracted from the match condition. If a mean RT is below zero, that means that the participants displayed longer RTs for mismatch than for match items. If the result is above zero, then the match items evoked longer RTs, and if the result is around zero, that means that there was no difference between the two conditions. As it could be seen in Figure 40, no group shows processing cost for mismatch items, because the mean RTs for each segment are around zero.

Table 59. Mean RTs in milliseconds (SD is given in parentheses) to past simple items across the 4 critical segments.

		Verb *felt*	Verb+1 *unhappy*	Verb+2 *at*	Verb+3 *work*
L1 German	match	422 (172)	413 (168)	444 (219)	454 (221)
	mismatch	424 (196)	413 (198)	419 (202)	422 (216)
L1 Croatian	match	374 (232)	337 (148)	348 (243)	357 (173)
	mismatch	341 (122)	337 (126)	350 (219)	355 (183)
L1 Spanish	match	409 (283)	373 (195)	386 (211)	405 (257)
	mismatch	415 (249)	368 (195)	362 (185)	407 (239)

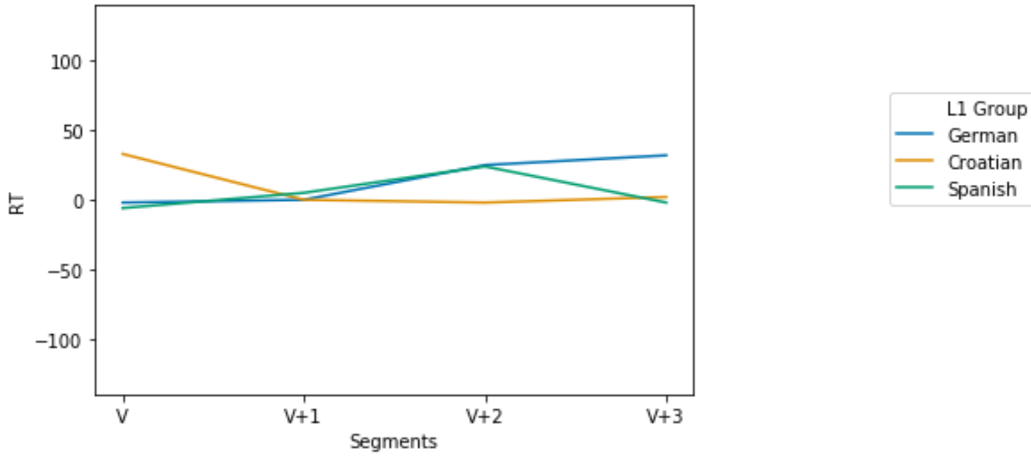

Figure 40. Mean reading times (RTs) in milliseconds on match conditions minus mismatch conditions for the past simple items across the 4 critical segments per group.

The linear effects model run on the Verb segment with Group, Type and AJT as fixed effects and Participant and Type as random effects showed no main effects nor any interaction. Table 60 summarizes the findings of the model for the past simple items. Therefore, no effect of Type was found on the Verb segment.

Table 60. Output from linear-mixed effects models run on past simple raw RTs data for all groups ($N = 73$) combined on the Verb segment. The fixed factors included: Group (German, Croatian and Spanish), Type (early vs. late closure) and Proficiency.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	421.09	34.91	12.06	< .001
GroupCroatian	-48.33	45.94	-1.05	.30
GroupSpanish	-15.87	50.46	-0.31	.75
Type	3.70	22.16	0.17	.87
AJT	25.27	33.62	0.75	.46
GroupCroatian*Type	-36.42	28.70	-1.27	.21
GroupSpanish*Type	7.29	31.81	0.23	.82
GroupCroatian*AJT	-30.00	44.76	-0.67	.51
GroupSpanish*AJT	-24.18	53.99	-0.45	.66
TypeMismatch*AJT	7.30	21.17	0.35	.73
GroupCroatian*Type*AJT	-7.88	28.07	-0.28	.78
GroupSpanish*Type*AJT	-42.29	34.11	-1.24	.22

Formula in R: *V ~ Group*Type*scale(AJT) + (1 + Type|Participant) + (1+Type|Item)*

Table 61 summarizes the findings on the segment after the verb (i.e., Verb+1). The model showed a main effect of Group:L1 Croatian indicating that the L1 Croatian group read faster than the L1 German group in both match and mismatch condition. Aside from the main effect of Group, a marginal interaction of Type and AJT was found, meaning that the offline test on tense and aspect marginally influenced the processing of match and mismatch items.

Table 61. Output from linear-mixed effects models run on past simple raw RTs data for all groups ($N = 73$) combined on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	411.13	26.01	15.81	< .001
GroupCroatian	-74.50	35.16	-2.12	**.04**
GroupSpanish	-39.65	38.58	-1.03	.31
Type	3.85	15.70	0.25	.81
AJT	19.88	25.66	0.78	.44
GroupCroatian*Type	-4.42	21.16	-0.21	.83
GroupSpanish*Type	-6.44	23.40	-0.28	.78
GroupCroatian*AJT	-39.82	34.14	-1.17	.25
GroupSpanish*AJT	-32.48	41.31	-0.79	.43
TypeMismatch*AJT	26.27	15.47	1.70	**.09**
GroupCroatian*Type*AJT	-5.59	20.47	-0.27	.78
GroupSpanish*Type*AJT	-19.78	25.14	-0.79	.43

Formula in R: *V1 ~ Group*Type*scale(AJT) + (1 + Type|Participant) + (1+Type|Item)*

Segment Verb+2 showed a similar pattern as the Verb+1 segment, i.e. the only effect that was found was the main effect of Group:L1 Croatian. Once again, the difference was shown in slower RTs for the L1 German group when compared to the L1 Croatian group (Table 62).

Table 62. Output from linear-mixed effects models run on past simple raw RTs data for all groups ($N = 73$) combined on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	442.92	31.49	14.07	< .001
GroupCroatian	-96.94	41.89	-2.31	**.02**
GroupSpanish	-60.05	46.00	-1.31	.20
Type	-22.17	22.12	-1.00	.32
AJT	29.05	30.63	0.95	.35
GroupCroatian*Type	24.86	28.59	0.87	.38
GroupSpanish*Type	3.54	31.74	0.11	.91
GroupCroatian*AJT	-30.87	40.76	-0.76	.45
GroupSpanish*AJT	-53.90	49.24	-1.10	.28
TypeMismatch*AJT	14.70	21.21	0.69	.49
GroupCroatian*Type*AJT	-1.05	28.11	-0.04	.97
GroupSpanish*Type*AJT	14.73	34.14	0.43	.67

Formula in R: *V2 ~ Group*Type*scale(AJT) + (1 + Type|Participant) + (1+Type|Item)*

Following the results of the previous two segments, the Verb+3 segment showed the same main effect, namely, Group: L1 Croatian (Table 63). Therefore, L1 Croatian learners had shorter reading times compared to the L1 German group, regardless of the condition (match vs. mismatch).

Table 63. Output from linear-mixed effects models run on past simple raw RTs data for all groups ($N = 73$) combined on the Verb+3 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	452.23	33.57	13.47	< .001
GroupCroatian	-96.67	43.54	-2.22	**.03**
GroupSpanish	-47.85	47.83	-1.00	.32
Type	-27.77	21.35	-1.30	.20
AJT	43.36	31.87	1.36	.18
GroupCroatian*Type	27.64	28.48	0.97	.34
GroupSpanish*Type	30.79	31.63	0.97	.33
GroupCroatian*AJT	-38.37	42.43	-0.90	.37
GroupSpanish*AJT	-74.22	51.18	-1.45	.15
TypeMismatch*AJT	0.07	21.20	0.003	.99
GroupCroatian*Type*AJT	4.25	28.15	0.15	.88
GroupSpanish*Type*AJT	7.02	33.96	0.21	.84

Formula in R: *V3 ~ Group*Type*scale(AJT) + (1 + Type|Participant) + (1+Type|Item)*

The summary of the past simple results showed no effect of Type, but an effect of Group on three critical segments (i.e., Verb+1, Verb+2, Verb+3), which was visible in longer reading times for L1 German learners in both conditions. There was also an interaction of Type and AJT on the V+1 segment which was marginally significant.

3.6.5.2.2. Omnibus analysis: present perfect.

In the following, the analysis on the raw RTs on the critical segments of the sentences with the verbs in the present perfect will be presented. Table 64 presents raw reading times of each segment by condition for all L1 groups. Figure 41 visualizes the relative RTs in the same manner as for the past simple items. As it could be seen in Figure 41, for the Verb+1, Verb+2 and Verb+3 segments, the means for all groups seem to be close to zero. Only in the first segment is the difference visible, but the difference is shown in higher RTs for match items for the L1 Spanish group than for other L1 groups.

Table 64. Mean RTs in milliseconds (SD is given in parentheses) to present perfect items across the 4 critical segments.

		Verb *has*	Verb+1 *felt*	Verb+2 *unhappy*	Verb+3 *at*
L1 German	match	407 (183)	409 (176)	391 (168)	417 (208)
	mismatch	402 (155)	419 (176)	417 (169)	427 (190)
L1 Croatian	match	337 (130)	342 (154)	355 (191)	351 (147)
	mismatch	350 (140)	365 (203)	371 (218)	341 (134)
L1 Spanish	match	386 (230)	365 (207)	395 (262)	397 (232)
	mismatch	336 (132)	348 (216)	387 (206)	404 (198)

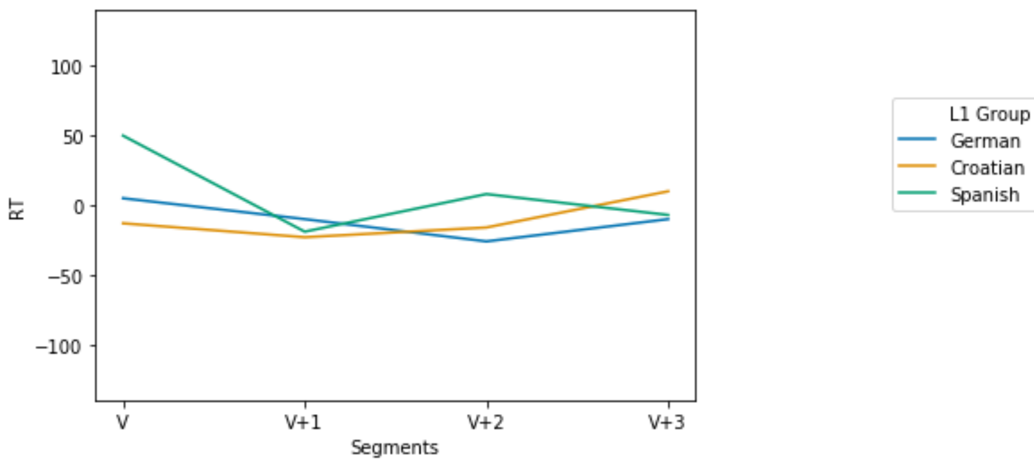

Figure 41. Mean reading times (RTs) in milliseconds on match conditions minus mismatch conditions for the present perfect items across the 4 critical segments per groups.

The linear mixed effects model for the present perfect items used the same fixed factors (Group, Type and AJT) and random factors (Participant and Item) as the model applied for the past simple items (Table 65). The model run on the Verb segment revealed a significant difference of Group:L1 Croatian, again showing the difference in reading speed between the L1 German and L1 Croatian group. A marginal interaction of Group:L1 Spanish and AJT was found, along with a marginal interaction of Group:L1 Spanish, Type and AJT.

Table 65. Output from linear-mixed effects models run on present perfect raw RTs data for all groups (*N* = 73) combined on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	411.39	26.00	15.82	< .001
GroupCroatian	-74.38	34.92	-2.13	**.04**
GroupSpanish	-28.63	38.46	-0.74	.46
Type	-9.64	17.49	-0.55	.58
AJT	24.54	25.42	0.97	.34
GroupCroatian*Type	20.63	23.56	0.88	.38
GroupSpanish*Type	-36.86	26.06	-1.41	.16
GroupCroatian*AJT	-41.26	33.86	-1.22	.23
GroupSpanish*AJT	-79.57	41.00	-1.94	**.06**
TypeMismatch*AJT	-10.54	17.12	-0.62	.54
GroupCroatian*Type*AJT	23.29	22.88	1.02	.31
GroupSpanish*Type*AJT	54.73	27.76	1.97	**.05**

Formula in R: *V ~ Group*Type*scale(AJT) + (1 + Type|Participant) + (1+Type|Item)*

The Verb+1 segment also revealed similar finding as the Verb segment. In other words, other than a significant main effect of Group for L1 Croatian, a marginal interaction of Group: L1 Spanish, Type and AJT was detected. Table 66 lists all the results from the model.

Table 66. Output from linear-mixed effects models run on present perfect raw RTs data for all groups ($N = 73$) combined on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	412.17	24.61	16.75	< .001
GroupCroatian	-69.52	32.87	-2.12	**.04**
GroupSpanish	-48.84	36.29	-1.35	.18
Type	5.51	20.29	0.27	.79
AJT	25.69	23.92	1.07	.29
GroupCroatian*Type	13.36	26.88	0.50	.62
GroupSpanish*Type	13.54	29.75	0.46	.65
GroupCroatian*AJT	-47.25	31.87	-1.48	.14
GroupSpanish*AJT	-53.81	38.63	-1.39	.17
TypeMismatch*AJT	31.09	19.52	1.59	.12
GroupCroatian*Type*AJT	-1.36	26.08	-0.05	.96
GroupSpanish*Type*AJT	-57.28	31.69	-1.81	**.08**

Formula in R: *V1 ~ Group*Type*scale(AJT) + (1 + Type|Participant) + (1+Type|Item)*

The model run on the Verb+2 segment revealed an interaction of Group:L1 Spanish, Type and AJT. The results suggest that L1 Spanish learners were affected by the AJT when processing match and mismatch items. Table 67 summarizes the results of the Verb+2 segment.

Table 67. Output from linear-mixed effects models run on present perfect raw RTs data for all groups (*N* = 73) combined on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	393.93	29.60	13.31	< .001
GroupCroatian	-38.70	39.87	-0.97	.34
GroupSpanish	-1.59	43.94	-0.04	.97
Type	21.42	20.59	1.04	.30
AJT	22.61	29.00	0.78	.44
GroupCroatian*Type	-8.37	27.81	-0.30	.76
GroupSpanish*Type	-28.56	30.78	-0.93	.36
GroupCroatian*AJT	-27.04	38.62	-0.70	.49
GroupSpanish*AJT	-11.04	46.81	-0.24	.81
TypeMismatch*AJT	11.19	20.17	0.56	.58
GroupCroatian*Type*AJT	-5.35	26.94	-0.20	.84
GroupSpanish*Type*AJT	-86.90	32.77	-2.65	**.01**

Formula in R: *V2 ~ Group*Type*scale(AJT) + (1 + Type|Participant) + (1+Type|Item)*

The last critical segment, i.e. the Verb+3 segment, showed a marginal main effect of Group:L1 Croatian and a main effect of AJT (Table 68). The interactions found were between Group:L1 Croatian and AJT; and Group:L1 Spanish and AJT.

Table 68. Output from linear-mixed effects models run on present perfect raw RTs data for all groups (N = 73) combined on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	421.64	27.44	15.37	< .001
GroupCroatian	-69.44	36.11	-1.92	**.06**
GroupSpanish	-28.20	39.81	-0.71	.48
Type	4.94	18.85	0.26	.79
AJT	70.51	26.34	2.68	**.01**
GroupCroatian*Type	-17.00	25.14	-0.68	.50
GroupSpanish*Type	3.15	27.84	0.11	.91
GroupCroatian*AJT	-78.40	35.10	-2.23	**.03**
GroupSpanish*AJT	-104.51	42.44	-2.46	**.02**
TypeMismatch*AJT	-30.76	18.39	-1.67	.10
GroupCroatian*Type*AJT	37.12	24.62	1.51	.14
GroupSpanish*Type*AJT	24.50	29.69	0.83	.41

Formula in R: *V3 ~ Group*Type*scale(AJT) + (1 + Type|Participant) + (1+Type|Item)*

All in all, the L1 Croatian group tended to be faster in reading times when compared to the L1 German group for both past simple and perfect items. The analysis of the past simple items also revealed interactions of Type and AJT, but no interaction of Group and Type. The analysis of the present perfect items showed an interaction of Group:L1 Spanish and Type on the Verb segment; and an interaction of Spanish, Type and AJT on the Verb+1 and Verb+2 segment. No interactions of Type and L1 Croatian nor Type were found on any of the critical segments. Because three-way interactions of Group, Type and AJT were found, especially in the case of present perfect items, the data was split in half by using a median split, based on participants' results on the AJT. The following paragraph looks at the RTs of learners who are split into those who scored lower on the AJT (low AJT group) and those who scored high on the AJT (high AJT group).

3.6.5.2.3. Omnibus analysis: tense awareness.

A median split based on the overall results of the groups in the AJT was performed, which separated learners into a low tense awareness and a high tense awareness group. Because the AJT aimed at primarily looking at mismatches between the fronted temporal adverbial and the verb following it, and not on knowledge of tense in general, I decided to define the task as testing the awareness of tense. First, the results of the past simple items will be presented, starting with the low awareness group and followed by the high awareness group. The same procedure will be repeated for the present perfect items. Figure 42 shows a processing cost for the low tense awareness group in the case of past simple items on the critical segments.

Past simple

Figure 42 shows slightly different patterns on the Verb segment per group. The L1 Spanish group has faster RTs for the match items, the L1 Croatian group has faster RTs for the mismatch items and the L1 German group has the same RTs for both conditions. There are also slight differences between the groups on the Verb V+2 segment, however, the differences are usually not more than 50 ms. On the Verb+2 segment, L1 German and L1 Spanish group display longer RTs for the match condition, while the L1 Croatian show no differences between the match and mismatch condition. In the following, a linear mixed effects model is used to test if the differences in RTs are statistically significant. The model includes Group and Type as fixed factors, Participant and Item as random intercepts and Type as a random slope for both intercepts. The baseline group for the model is the L1 German group.

Table 69. Mean RTs in milliseconds (SD is given in parentheses) to past simple items for low awareness AJT group across the 4 critical segments.

		Verb *felt*	Verb+1 *unhappy*	Verb+2 *at*	Verb+3 *work*
L1 German	match	421 (173)	411 (179)	442 (221)	438 (206)
	mismatch	418 (194)	394 (194)	400 (198)	410 (216)
L1 Croatian	match	378 (146)	356 (154)	349 (119)	366 (129)
	mismatch	351 (113)	346 (109)	348 (128)	352 (112)
L1 Spanish	match	402 (252)	371 (146)	393 (170)	413 (231)
	mismatch	430 (233)	364 (164)	360 (141)	421 (216)

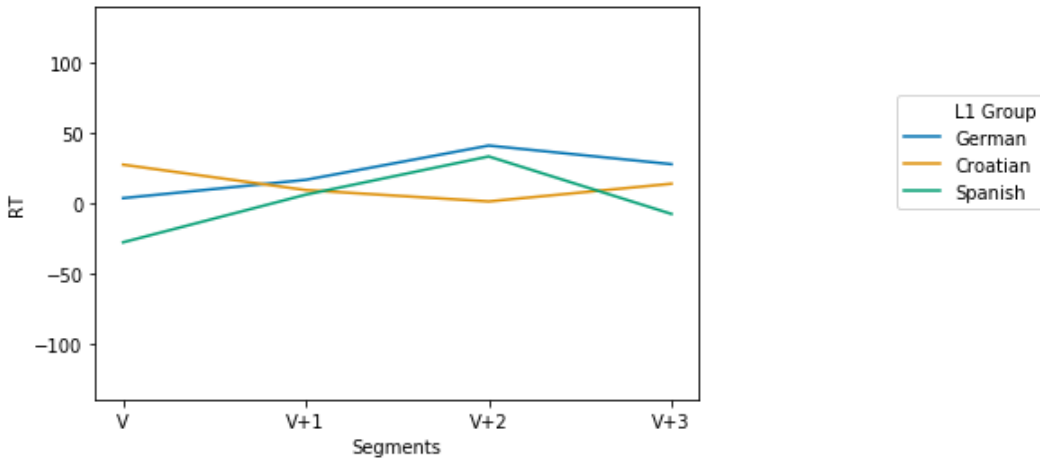

Figure 42. Low tense awareness group by language. Mean reading times (RTs) in milliseconds on match conditions minus mismatch conditions for the past simple items across the 4 critical segments per group: L1 German (*n* = 11), L1 Croatian (*n* = 18), L1 Spanish (*n* = 8).

Even though Figure 42 showed slight differences among the groups on the Verb segment, the model revealed no significant results for the low tense awareness group in the past simple (Table 70). Therefore, a main effect of Type was not observed.

Table 70. Output from linear-mixed effects models run on past simple raw RTs data for the low tense awareness group (*n* = 37) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	417.54	34.24	12.19	< .001
GroupCroatian	-41.21	44.49	-0.93	.36
GroupSpanish	-15.18	50.03	-0.30	.76
Type	0.46	21.01	0.02	.98
GroupCroatian*Type	-26.46	27.19	-0.97	.33
GroupSpanish*Type	29.66	30.88	0.96	.34

Formula in R: *V ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

Similarly to the Verb segment, the Verb+1 segment also displayed no main effects nor any interactions for the low tense awareness group, which could have also been observed from Figure 42. Table 71 summarizes the results from the mixed effects model.

Table 71. Output from linear-mixed effects models run on past simple raw RTs data for the low tense awareness group (n = 37) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	407.16	30.38	13.40	<.001
GroupCroatian	-53.34	40.2	-1.33	.19
GroupSpanish	-34.12	45.22	-0.75	.45
Type	-12.01	18.70	-0.64	.52
GroupCroatian*Type	3.44	24.76	0.14	.89
GroupSpanish*Type	4.70	28.08	0.17	.87
Formula in R: *V1 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*				

The Verb+2 segment, however, found a main effect of Group: L1 Croatian, which signals that the L1 Croatian group acted differently from the L1 German group (see Table 72). A main effect of Type was also observed, which indicated that all groups had found it more difficult to read match than mismatch sentences.

Table 72. Output from linear-mixed effects models run on past simple raw RTs data for the low tense awareness group (n = 37) on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	438.15	29.30	14.95	<.001
GroupCroatian	-90.55	38.65	-2.34	**.02**
GroupSpanish	-45.35	43.47	-1.04	.30
Type	-36.38	19.63	-1.85	**.07**
GroupCroatian*Type	36.29	26.01	1.40	.17
GroupSpanish*Type	3.86	29.51	0.13	.90
Formula in R: *V2 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*				

The Verb+3 segment followed a similar pattern as the Verb and Verb+1 segment, and showed no significant results for the low tense awareness group in the case of past simple items (Table 73).

Table 73. Output from linear-mixed effects models run on past simple raw RTs data for the low tense awareness group (n = 37) on the Verb+3 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	431.38	35.51	12.15	<.001
GroupCroatian	-72.18	45.78	-1.58	.12
GroupSpanish	-14.76	51.49	-0.29	.78
Type	-19.90	23.89	-0.83	.41
GroupCroatian*Type	14.07	30.95	0.46	.65
GroupSpanish*Type	25.17	35.04	0.72	.48

Formula in R: *V3 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

Figure 43 displays raw reading times of the high tense awareness group in the case of past simple items. On the Verb segment, the L1 Croatian and L1 Spanish group show processing costs for the match conditions, and the German L1 group shows no differences between the conditions. The Verb+1 and Verb+2 show no processing costs for the mismatch items in any of the groups. On the Verb+3 segment there seems to be a slight processing cost of the mismatch items for L1 Croatian learners, yet, the cost is around 10-20 ms, which is not a big difference between the conditions. In order to test the differences between groups, the results of the models will be presented in the following.

Table 74. Mean RTs in milliseconds (SD is given in parentheses) to past simple items for high awareness AJT group across the 4 critical segments.

		Verb *felt*	Verb+1 *unhappy*	Verb+2 *at*	Verb+3 *work*
L1 German	match	424 (172)	417 (149)	450 (217)	486 (246)
	mismatch	436 (203)	450 (204)	457 (208)	446 (216)
L1 Croatian	match	362 (371)	289 (119)	345 (419)	337 (253)
	mismatch	315 (142)	312 (161)	357 (364)	365 (300)
L1 Spanish	match	422 (336)	377 (265)	374 (273)	389 (302)
	mismatch	389 (276)	374 (244)	367 (247)	384 (276)

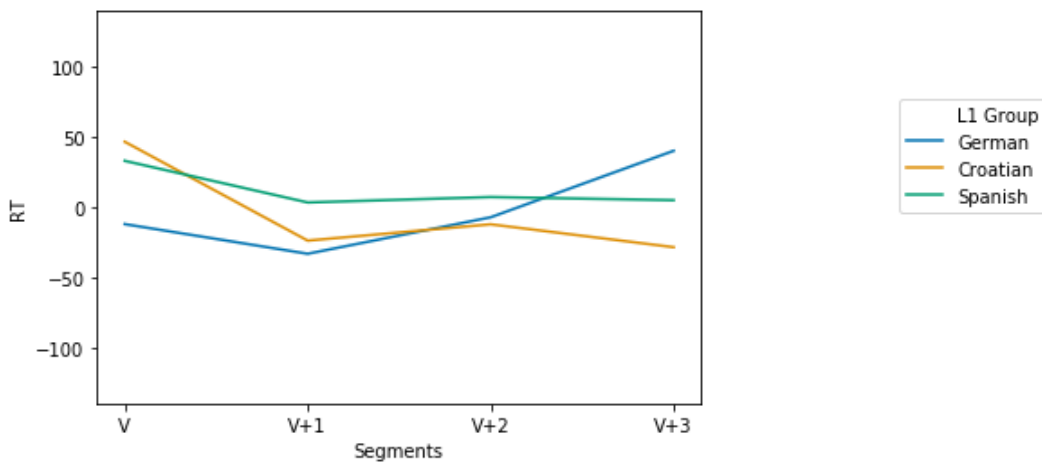

Figure 43. High tense awareness group by language. Mean reading times (RTs) in milliseconds on match conditions minus mismatch conditions for the past simple items across the 4 critical segments per groups: L1 German (n = 13), L1 Croatian (n = 11), L1 Spanish (n = 12).

Similarly to the low tense awareness group, the Verb segment of the past simple items showed no main effects nor any interactions for the high tense awareness group. Table 75 lists all the results of the linear-mixed effects model on the Verb segment.

Table 75. Output from linear-mixed effects models run on past simple raw RTs data for the high tense awareness group (n = 36) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	428.63	82.13	5.22	<.001
GroupCroatian	-65.10	114.40	-0.57	.58
GroupSpanish	-14.90	118.29	-0.13	.90
Type	6.20	55.85	0.11	.91
GroupCroatian*Type	-56.21	76.75	-0.73	.47
GroupSpanish*Type	-31.21	79.46	-0.39	.70

Formula in R: *V ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

On the Verb+1 segment there was only a marginal main effect of Group:L1 Croatian, meaning that the L1 Croatian group read faster than the baseline L1 German group (Table 76). The same effect was also visible in the omnibus analysis, noting higher RTs for the L1 German group, regardless of the condition.

Table 76. Output from linear-mixed effects models run on past simple raw RTs data for the high tense awareness group (n = 36) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	417.46	50.26	8.31	<.001
GroupCroatian	-127.20	70.97	-1.79	**.09**
GroupSpanish	-47.64	73.57	-0.65	.52
Type	33.37	32.28	1.03	.30
GroupCroatian*Type	-11.28	45.18	-0.25	.80
GroupSpanish*Type	-28.07	47.15	-0.60	.55

Formula in R: *V1 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

Similarly to the Verb segment, the results of the Verb+2 segment show no significant results for the high tense awareness group (Table 77).

Table 77. Output from linear-mixed effects models run on past simple raw RTs data for the high tense awareness group (n = 36) on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	452.91	76.64	5.91	<.001
GroupCroatian	-108.93	107.35	-1.02	.32
GroupSpanish	-87.02	111.17	-0.78	.44
Type	1.53	56.17	0.03	.98
GroupCroatian*Type	8.01	77.07	0.10	.92
GroupSpanish*Type	-0.91	79.79	-0.01	.99

Formula in R: *V2 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

Finally, Table 78 sums up the results of the linear-mixed effects model for the Verb+3 segment. The results do not differ much from the last segment, showing no significant differences between groups nor conditions.

Table 78. Output from linear-mixed effects models run on past simple raw RTs data for the high tense awareness group (n = 36) on the Verb+3 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	486.92	72.77	6.69	<.001
GroupCroatian	-144.08	102.06	-1.41	.17
GroupSpanish	-107.15	105.66	-1.01	.32
Type	-43.53	50.24	-0.87	.40
GroupCroatian*Type	54.48	66.77	0.82	.43
GroupSpanish*Type	44.72	68.98	0.65	.53

Formula in R: *V3 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

Present perfect

Figure 44 depicts processing cost for each critical segments of the low tense awareness group in the case of present perfect items. The Verb segments shows longer RTs for the match items by the L1 Spanish group and no difference in RTs for match and mismatch condition for the

L1 German and L1 Croatian group. The Verb+1 segment reverses the reading times for the L1 Spanish group, this time showing a processing cost of around 45ms for the mismatch items. The RTs of the other two L1 groups stays the same. The Verb+2 segment shows that the reading times of all groups are slightly below zero, however, the difference between the match and mismatch items does not seem to be big. Finally, on the Verb+3 segment it seems the L1 German and L1 Spanish group stay below zero, while the L1 Croatian group shows no processing costs for both conditions.

Table 79. Mean RTs in milliseconds (SD is given in parentheses) to present perfect items for low awareness AJT group across the 4 critical segments.

		Verb *has*	Verb+1 *felt*	Verb+2 *unhappy*	Verb+3 *at*
L1 German	match	396 (184)	398 (173)	381 (170)	374 (165)
	mismatch	403 (169)	399 (186)	410 (175)	418 (190)
L1 Croatian	match	357 (127)	368 (151)	358 (131)	363 (138)
	mismatch	352 (120)	362 (135)	373 (146)	341 (115)
L1 Spanish	match	403 (226)	383 (207)	380 (201)	418 (241)
	mismatch	347 (127)	423 (216)	416 (232)	436 (215)

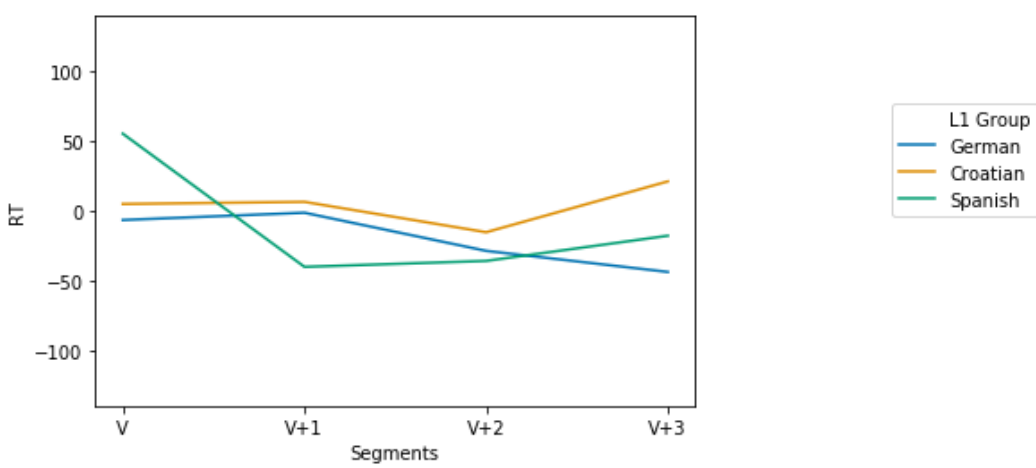

Figure 44. Low tense awareness group by language. Mean reading times (RTs) in milliseconds on match conditions minus mismatch conditions for the present perfect items across the 4 critical segments per groups: L1 German (n = 11), L1 Croatian (n = 18), L1 Spanish (n = 8).

When it comes to the low tense awareness group, there were no significant differences on the Verb segment for the present perfect items. Table 80 sums up the results of the mixed effects model.

Table 80. Output from linear-mixed effects models run on present perfect raw RTs data for the low tense awareness group (*n* = 37) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	402.63	31.16	12.92	<.001
GroupCroatian	-45.54	41.24	-1.10	.28
GroupSpanish	-4.41	46.56	-0.10	.93
Type	-1.1	21.39	-0.05	.96
GroupCroatian*Type	-5.67	28.23	-0.20	.84
GroupSpanish*Type	-51.96	32.05	-1.62	.11

Formula in R: *V ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

There were also no significant main effects and interactions found on the Verb+1 segments for the low tense awareness group (Table 81), similarly to the Verb segment for the present perfect items.

Table 81. Output from linear-mixed effects models run on present perfect raw RTs data for the low tense awareness group (*n* = 37) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	402.56	29.10	13.42	<.001
GroupCroatian	-34.32	39.44	-0.87	.39
GroupSpanish	-23.10	44.59	-0.52	.61
Type	-7.35	21.55	-0.34	.73
GroupCroatian*Type	-2.31	28.02	-0.08	.93
GroupSpanish*Type	47.25	31.87	1.48	.14

Formula in R: *V1 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

Table 82 lists the results on the Verb+2 segment and also show no significant differences between groups and conditions.

Table 82. Output from linear-mixed effects models run on present perfect raw RTs data for the low tense awareness group (n = 37) on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	385.42	28.60	13.48	<.001
GroupCroatian	-27.06	37.89	-0.71	.48
GroupSpanish	-10.49	42.83	-0.25	.81
Type	21.09	25.07	0.84	.40
GroupCroatian*Type	-6.10	33.25	-0.21	.83
GroupSpanish*Type	17.47	37.68	0.46	.65

Formula in R: *V2 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

The Verb+3 segment, however, reveals a marginally significant main effect of Type (Table 83). This can be viewed in slightly longer reading times for the mismatch items for all groups. There was also an interaction of Group:L1 Croatian and Type which advocates for differences between the L1 Croatian and L1 German group, however, both groups' processing costs are around zero.

Table 83. Output from linear-mixed effects models run on present perfect raw RTs data for the low tense awareness group (n = 37) on the Verb+3 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	378.75	30.09	12.59	<.001
GroupCroatian	-15.98	39.79	-0.40	.69
GroupSpanish	34.87	44.97	0.78	.44
Type	37.18	21.35	1.74	**.09**
GroupCroatian*Type	-59.95	28.24	-2.12	**.04**
GroupSpanish*Type	-19.55	32.10	-0.61	.55

Formula in R: *V3 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

Figure 45 shows processing costs for all L1 groups on each critical segment for the high tense awareness group in the case of present perfect items. The graph shows bigger differences between groups and conditions than the graph of the low tense awareness group. On the Verb segment, the only group that showed processing cost was the L1 Croatian group with around 60ms of difference between the match and mismatch condition. The L1 German and L1 Croatian RTs are slightly above zero, which also continues on the Verb+1 segment. The L1 Croatian group seems to show a bigger difference, of around 95ms, on the Verb+1 segment. The processing cost of the L1 Croatian group disappears on the Verb+2 and Verb+3 segment. The L1 Spanish group shows longer RTs for the match condition on the Verb+2 segment, which equalizes to zero on the Verb+3 segment. The L1 German group, however, shows no processing cost on the Verb+2 segment and higher RTs for the match condition on the Verb+3 segment.

Table 84. Mean RTs in milliseconds (SD is given in parentheses) to present perfect items for high awareness AJT group across the 4 critical segments.

		Verb *has*	Verb+1 *felt*	Verb+2 *unhappy*	Verb+3 *at*
L1 German	match	428 (183)	431 (180)	409 (163)	499 (253)
	mismatch	401 (127)	458 (149)	429 (159)	444 (191)
L1 Croatian	match	283 (122)	275 (143)	348 (297)	320 (165)
	mismatch	345 (183)	375 (323)	367 (346)	342 (176)
L1 Spanish	match	357 (239)	334 (222)	421 (348)	358 (213)
	mismatch	316 (142)	316 (146)	334 (140)	346 (148)

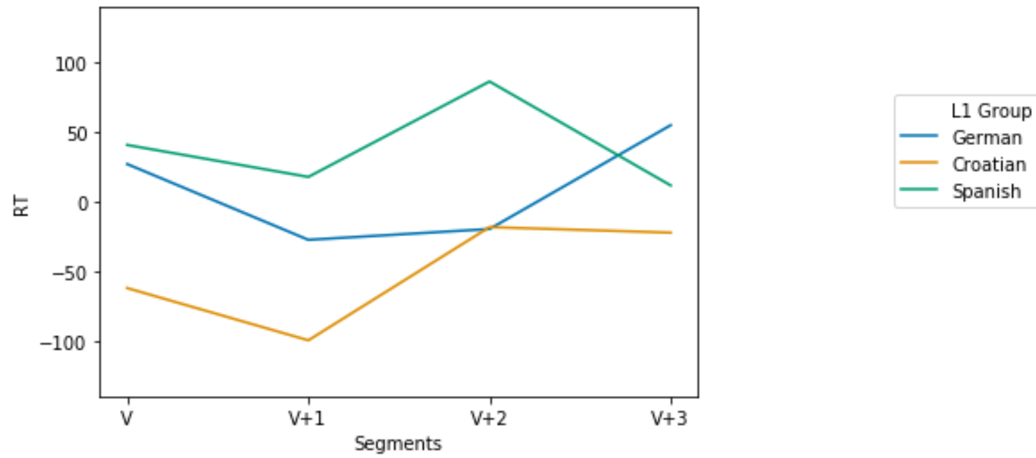

Figure 45. High tense awareness group by language. Mean reading times (RTs) in milliseconds on match conditions minus mismatch conditions for the present perfect items across the 4 critical segments per groups: L1 German (*n* = 13), L1 Croatian (*n* = 11), L1 Spanish (*n* = 12).

The high tense awareness group displayed a main effect of Group:L1 Croatian and a marginal interaction of Group: L1 Croatian and Type for the present perfect items (Table 85). The main effect shows higher RTs for the L1 German group when compared to the L1 Croatian group. The interaction will be discussed in the continuation, after the analyses of all segments.

Table 85. Output from linear-mixed effects models run on present perfect raw RTs data for the high tense awareness group (*n* = 36) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	428.31	49.09	8.73	<.001
GroupCroatian	-143.57	68.55	-2.09	**.05**
GroupSpanish	-71.32	71.03	-1.00	.33
Type	-27.45	31.84	-0.86	.40
GroupCroatian*Type	82.99	45.27	1.83	**.08**
GroupSpanish*Type	-8.22	46.62	-0.18	.86

Formula in R: *V ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

The main effect of Group:L1 Croatian still continues on the Verb+1 segment (Table 86). There were no more significant differences found on the Verb+1 segment for the high tense awareness group.

Table 86. Output from linear-mixed effects models run on present perfect raw RTs data for the high tense awareness group (n = 36) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	430.25	40.93	10.51	<.001
GroupCroatian	-155.13	58.01	-2.67	**.01**
GroupSpanish	-94.98	60.42	-1.57	.13
Type	28.58	40.89	0.70	.49
GroupCroatian*Type	65.05	58.46	1.11	.28
GroupSpanish*Type	-44.66	60.67	-0.74	.47

Formula in R: *V1 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

On the Verb+2 segment, any main effects found of the Verb+1 segment were lost. Table 87 sums up the results of the high tense awareness group in the case of present perfect items.

Table 87. Output from linear-mixed effects models run on present perfect raw RTs data for the high tense awareness group (n = 36) on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	408.72	70.57	5.79	<.001
GroupCroatian	-61.7	99.77	-0.62	.54
GroupSpanish	16.59	103.56	0.16	.87
Type	20.36	43.77	0.47	.64
GroupCroatian*Type	-8.23	62.75	-0.13	.90
GroupSpanish*Type	-106.33	65.08	-1.63	.11

Formula in R: *V2 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

On the Verb+3 segment, the main effect of Group:L1 Croatian was again significant. No other main effects nor interactions were found for the present perfect items (Table 88).

Table 88. Output from linear-mixed effects models run on present perfect raw RTs data for the high tense awareness group (n = 36) on the Verb+3 segment.

	Estimate	SE	t-value	p-value
(Intercept)	500.02	58.00	8.62	<.001
GroupCroatian	-174.59	79.80	-2.19	**.04**
GroupSpanish	-144.45	82.54	-1.75	.10
Type	-55.92	38.14	-1.47	.16
GroupCroatian*Type	69.22	49.99	1.39	.18
GroupSpanish*Type	50.77	51.48	0.99	.34

Formula in R: *V3 ~ Group*Type + (1 + Type|Participant) + (1+Type|Item)*

To sum up, the median split analysis found the main effect of Type on the Verb+2 segment for the past simple items in the case of low tense awareness group. The high tense awareness group showed no significant effects for past simple items. As for the present perfect items in the low tense awareness group, there was a main effect of Type and a Group:L1 Croatian and Type interaction on the Verb+3 segment. The low tense awareness group displayed an interaction of Group:L1 Croatian and Type which showed a difference between the L1 German and L1 Croatian group, as the L1 Croatian group was much faster in reading the match items than the mismatch items. The high tense awareness group recorded a marginal interaction of Group:L1 Croatian and Type with L1 Croatian showing a processing cost for the match items.

In the next paragraphs, a by-group analysis will be performed due to interactions between Group:L1 Croatian and Type on the Verb+3 segment for low awareness group in the case of present perfect items, and on the Verb section for high awareness group in the case of present perfect items.

3.6.5.2.4. By-group analysis.

The next analyses will be individual analyses of L1 Groups in order to see if they show the main effect of Type and if the L1 Groups differ between each other. The linear mixed effects model used in this study was done on each critical segment and it included Type and AJT as fixed factors, Participant and Item as random intercepts and Type as a random slope for both intercepts. Each L1 Group will be analyzed separately on past simple and present perfect.

L1 German group

The first group to be reported is the L1 German group. In the case of past simple items on the Verb segment, no main effect of Type was found, among other non-significant results (Table 89).

Table 89. Output from linear-mixed effects models run on past simple raw RTs data for the L1 German group (*n* = 24) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	420.50	29.09	14.46	<.001
Type	2.18	17.65	0.12	.90
AJT	23.98	29.13	0.82	.42
Type*AJT	9.06	15.28	0.59	.55
Formula in R: *V ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*				

The Verb+1 segment also did not show any significant results, as could be seen in Table 90.

Table 90. Output from linear-mixed effects models run on past simple raw RTs data for the L1 German group (*n* = 24) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	410.87	27.22	15.12	<.001
Type	3.19	16.08	0.20	.84
AJT	20.04	27.27	0.74	.47
Type*AJT	26.78	16.11	1.66	.10
Formula in R: *V1 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*				

The Verb+2 segment followed the same pattern as the previous two segments by not showing any main effect nor any interaction (Table 91).

Table 91. Output from linear-mixed effects models run on past simple raw RTs data for the L1 German group (n = 24) on the Verb+2 segment.

	Estimate	SE	t-value	p-value
(Intercept)	442.55	33.10	13.45	<.001
Type	-22.23	19.37	-1.15	.26
AJT	27.23	32.52	0.84	.41
Type*AJT	18.84	18.66	1.01	.31

Formula in R: *V2 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

Finally, Table 92 lists the results of the mixed effects model on the Verb+3 segment. Similarly to the other critical segments, the Verb+3 segment also did not show significant differences between the match and mismatch items in the past simple.

Table 92. Output from linear-mixed effects models run on past simple raw RTs data for the L1 German group (n = 24) on the Verb+3 segment.

	Estimate	SE	t-value	p-value
(Intercept)	450.39	36.07	12.49	<.001
Type	-28.74	27.19	-1.06	.30
AJT	41.28	36.12	1.14	.27
Type*AJT	7.91	27.23	0.29	.77

Formula in R: *V3 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

In the case of present perfect items, the L1 German group showed no significant results on the Verb segment (Table 93).

Table 93. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 German group (*n* = 24) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	410.73	28.50	14.41	<.001
Type	-9.00	14.76	-0.61	.55
AJT	25.22	28.48	0.89	.39
Type*AJT	-11.28	14.84	-0.76	.46
Formula in R: *V ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*				

The Verb+1 segment also revealed no significant results for the present perfect items in the case of L1 German learners (Table 94).

Table 94. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 German group (*n* = 24) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	412.33	28.81	14.31	<.001
Type	5.07	19.07	0.27	.79
AJT	29.72	27.17	1.09	.29
Type*AJT	27.52	16.08	1.71	.10
Formula in R: *V1 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*				

The Verb+2 segment follow the same trend as the previous two segments and showed no main effects nor any interactions. See Table 95 for results in detail.

Table 95. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 German group (n = 24) on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	394.07	25.78	15.28	<.001
Type	21.03	18.31	1.15	.26
AJT	22.69	25.78	0.88	.39
Type*AJT	11.50	18.24	0.63	.54

Formula in R: *V2 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

Table 96 lists results of the Verb+3 segment. The linear-mixed effects model revealed a main effect of AJT, indicating that depending on how the learners performed on the test, that affected how slow or fast they were reading the sentences. A marginally significant interaction of Type and AJT shows that the participants' awareness of tense in English affected how fast of slowly they read match vs. mismatch items. Therefore, the L1 German analysis documented no main effects of Type in the past simple nor present perfect tense, only the significant main effect of AJT and the marginally significant Type and AJT interaction on the Verb+3 segment.

Table 96. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 German group (n = 24) on the Verb+3 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	420.99	31.64	13.34	<.001
Type	5.43	21.39	0.25	.80
AJT	73.46	30.55	2.40	**.02**
Type*AJT	-33.92	19.07	-1.78	**.09**

Formula in R: *V3 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

L1 Croatian group

The L1 Croatian is the next group to be analyzed. Table 97 lists the results of the linear-mixed effects model for the past simple items for the Verb segment. This time, there were no significant results found on the critical segment.

Table 97. Output from linear-mixed effects models run on past simple raw RTs data for the L1 Croatian group (n = 29) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	372.47	32.64	11.47	<.001
Type	-31.86	27.16	-1.17	.25
AJT	-7.11	32.01	-0.22	.83
Type*AJT	2.02	26.15	0.08	.94

Formula in R: *V ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

The results of the Verb+1 segment showed a marginally significant interaction of Type and AJT (Table 98). No other results were found significant.

Table 98. Output from linear-mixed effects models run on past simple raw RTs data for the L1 Croatian group (n = 29) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	336.19	19.10	17.63	<.001
Type	0.09	12.36	0.01	.99
AJT	-20.81	19.20	-1.08	.29
Type*AJT	21.43	12.59	1.70	**.09**

Formula in R: *V1 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

The Verb+2 segment showed no significant results for the L1 Croatian group in the case of past simple items (Table 99).

Table 99. Output from linear-mixed effects models run on past simple raw RTs data for the L1 Croatian group (n = 29) on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	347.10	27.82	12.55	<.001
Type	2.55	24.57	0.10	.92
AJT	-1.95	27.84	-0.07	.95
Type*AJT	14.82	22.29	0.67	.51

Formula in R: *V2 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

Similarly to the Ver+2 segment, the Verb+3 segment also reveals no significant main effects nor interactions for past simple items (Table 100).

Table 100. Output from linear-mixed effects models run on past simple raw RTs data for the L1 Croatian group (n = 29) on the Verb+3 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	356.09	22.54	15.82	<.001
Type	-1.41	18.36	-0.08	.94
AJT	0.69	21.38	0.03	.98
Type*AJT	11.32	17.66	0.64	.52

Formula in R: *V3 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

When it comes to present perfect items, the results did not show a significant main effect nor a significant interaction for the L1 Croatian group on the Verb segment (Table 101).

Table 101. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 Croatian group (n = 29) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	336.71	17.85	18.93	<.001
Type	11.01	15.98	0.69	.50
AJT	-18.33	17.88	-1.03	.31
Type*AJT	13.97	15.89	0.88	.39

Formula in R: *V ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

Table 102 shows the results of the mixed effects model, and as the previous segment, there were no significant results for the V+1 segment regarding the present perfect items.

Table 102. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 Croatian group (n = 29) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	342.47	20.60	16.63	<.001
Type	19.64	20.86	0.94	.35
AJT	-22.23	20.63	-1.08	.29
Type*AJT	30.64	20.88	1.47	.15

Formula in R: *V1 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

Similarly to the previous critical segment (V+1), the Verb+2 segment did not show a main effect of Type, nor the Type and AJT interaction (Table 103).

Table 103. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 Croatian group (n = 29) on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	355.08	27.45	12.94	<.001
Type	13.24	17.91	0.74	.46
AJT	-4.58	27.50	-0.17	.87
Type*AJT	6.15	17.92	0.34	.73

Formula in R: *V2 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

Finally, the V+3 segment follows the trends of all critical segment in the case of present perfect items and shows no significant results (Table 104). Summing up, the L1 Croatian group only displayed a marginally significant interaction of Type and AJT on the V+1 segment, and only for past simple items.

Table 104. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 Croatian group (n = 29) on the Verb+3 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	351.36	19.47	18.06	<.001
Type	-11.36	15.22	-0.75	.46
AJT	-9.61	18.79	-0.51	.61
Type*AJT	8.76	15.14	0.58	.57

Formula in R: *V3 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

L1 Spanish group

The L1 Spanish group was also analyzed separately on their RTs for past simple and present perfect items. Table 105 shows results for the Verb segment, only for the past simple items. No main effect and interactions are noted.

Table 105. Output from linear-mixed effects models run on past simple raw RTs data for the L1 Spanish group (n = 20) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	404.30	46.31	8.73	<.001
Type	12.34	30.83	0.40	.69
AJT	1.24	43.77	0.03	.98
Type*AJT	-31.21	28.49	-1.10	.28
Formula in R: *V ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*				

The Verb+1 segment also did not show significant difference between the match and mismatch condition. The results can be seen in Table 106.

Table 106. Output from linear-mixed effects models run on past simple raw RTs data for the L1 Spanish group (n = 20) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	371.84	34.42	10.84	<.001
Type	-2.60	25.71	-0.10	.92
AJT	-10.60	34.09	-0.31	.76
Type*AJT	5.99	21.17	0.28	.78
Formula in R: *V1 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*				

The results of the model on the Verb+2 segment do not show any differences between conditions (Table 107). Therefore, the main effect of Type is also not recorded on the Verb+2 segment in the case of past simple items.

Table 107. Output from linear-mixed effects models run on past simple raw RTs data for the L1 Spanish group (n = 20) on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	380.58	35.32	10.83	<.001
Type	-17.17	24.08	-0.71	.48
AJT	-22.27	33.57	-0.66	.52
Type*AJT	25.87	22.99	1.13	.27

Formula in R: *V2 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

The results of the Verb+3 segment are similar to the previous critical segments. Therefore, no results were significant for the past simple items according to the model (Table 108).

Table 108. Output from linear-mixed effects models run on past simple raw RTs data for the L1 Spanish group (n = 20) on the Verb+3 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	400.78	45	89.17	<.001
Type	7.01	28.32	0.25	.81
AJT	-28.19	43.72	-0.65	.53
Type*AJT	7.85	27.83	0.28	.78

Formula in R: *V3 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

The same model was used on the present perfect items. The Verb segment showed a main effect of Type that is marginally significant, as well as a marginally significant interaction of Type and AJT (Table 109).

Table 109. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 Spanish group (*n* = 20) on the Verb segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	385.10	35.34	10.93	<.001
Type	-46.25	25.25	-1.83	**.08**
AJT	-51.14	32.20	-1.59	.13
Type*AJT	42.05	23.07	1.82	**.08**

Formula in R: *V ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

Contrary to the results on the Verb section, the Verb+1 segment showed no significant differences between the match and mismatch condition (Table 110). No results were found significant.

Table 110. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 Spanish group (*n* = 20) on the Verb+1 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	363.89	30.21	12.06	<.001
Type	21.44	27.21	0.79	.44
AJT	-24.84	26.21	-0.95	.36
Type*AJT	-22.92	24.99	-0.92	.36

Formula in R: *V1 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

Yet, the Verb+2 segment had the same Type and AJT interaction as the Verb segment. Results could be seen in Table 111.

Table 111. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 Spanish group (n = 20) on the Verb+2 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	393.52	37.71	10.46	<.001
Type	-6.84	31.31	-0.22	.83
AJT	10.46	36.46	0.29	.78
Type*AJT	-67.85	29.04	-2.34	**.03**

Formula in R: *V2 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

The final (Verb+3) segment revealed no significant differences between conditions for present perfect items, which can be seen in Table 112. In conclusion, the L1 Spanish group recorded a main effect of Type in the Verb segment for present perfect items. A Type and AJT interaction was found on the Verb and Verb+2 segment for present perfect items. Yet, the results go in the opposite direction as predicted, i.e. the L1 Spanish group read the match items more slowly than the mismatch items. No significant results were shown for the past simple items.

Table 112. Output from linear-mixed effects models run on present perfect raw RTs data for the L1 Spanish group (n = 20) on the Verb+3 segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	393.55	34.12	11.54	<.001
Type	9.30	25.51	0.37	.72
AJT	-28.65	33.66	-0.85	.41
Type*AJT	-7.36	24.80	-0.30	.77

Formula in R: *V3 ~ Type*AJT + (1 + Type|Participant) + (1+Type|Item)*

Because by-group analyses revealed an interaction of Type and AJT for all groups, a further analysis divided L1 group according to their scored on the AJT (via median split), however, no main effect of Type was found. The results of the analyses can be found in Appendix B: IV.

3.6.5.3. Overall summary.

The current study included three different L1 groups, namely, L1 German, L1 Croatian and L1 Spanish learners of English. The participants were tested on their knowledge of tense and aspect in three different tasks. The cloze test tested their knowledge of present simple, past simple and present perfect. The AJT looked at the grammaticality of the sentences with past simple and present perfect that matched and/or mismatched in tense with the temporal adverbial. Therefore, the participants' results were analyzed in their sensitivity to temporal adverbials that referred to a past completed event (i.e., past simple) or a past event with current relevance (i.e., present perfect). The SPR task used the same items as the AJT, but was aimed at testing online processing of L2 English tense/aspect distinctions.

The cloze test showed advanced knowledge of English tense; however, the L1 German scored lower than the L1 Croatian and L1 Spanish group. The AJT revealed that none of the learners was target-like at detecting the mismatch conditions, especially when it came to present perfect items. The analysis of the self-paced reading task did not reveal any difference in sensitivity to matches vs. mismatches in any group nor between groups. Further analysis on low- and high-awareness group also did not show any differences in sensitivity. Therefore, the groups did not show a processing cost as in the study by Roberts and Liszka (2013), regardless of the presence or absence of grammatical aspect in the L1. The findings of the current study will be discussed in more detail in the discussion.

3.6.6. Discussion.

The study investigated L2 processing of L2 English tense in three L1 learner groups: German, Croatian and Spanish. Furthermore, the study tested if the realization of tense and aspect conditions L1 crosslinguistic influence. Namely, the study used an AJT and an SPR task to test if L1 learners are sensitive to coreference agreement violations and if differences in the L1 realization of tense and aspect affect the results. The L1s in this study were strategically chosen based on the realization of tense, aspect and present perfect (Table 113).

Table 113. Crosslinguistic differences between L1s (German, Croatian and Spanish) and L2 English regarding tense and aspect

	English	German	Croatian	Spanish
Grammatical tense	+	+	+	+
Present perfect tense	+	–	–	+
Grammatical aspect	+	–	+	+

By selecting German, Croatian and Spanish, the study had a combination of languages that did not overlap completely on the realization of tense and aspect. In this case, German only grammaticalizes tense and uses a past tense similar in form to English present perfect, but the meaning of German *Perfekt* is similar to English past simple (i.e., preterit meaning). Croatian language grammaticalizes tense and aspect, and, similarly to German, has a past compound form (i.e., *perfekt*) that has a preterit meaning. In terms of aspect, Croatian encodes perfectivity/imperfectivity, which is different form the simple/progressive distinction in English. Spanish, on the other hand, is the most similar language to English (out of all L1s) based on the following criteria: it realizes tense and aspect grammatically, and it has a past tense that overlaps with the meanings of English present perfect, i.e. current relevance.

The AJT showed that learners were not as accurate at detecting mismatch conditions, and that, for both match and mismatch items, the learners did not perform at ceiling. This was especially the case with mismatch items with verbs in the present perfect, as the items were rated as accurate by all L1 Groups. Therefore, the learners did not show a native-like knowledge of tense in the AJT and the SPR task. Yet, in the cloze test, all three groups had a mean above 80%, indicating that the learners did not perform at chance. That means that different realizations of tense and aspect in the respective L1s did not affect the final results, and there was no crosslinguistic influence detected. The current findings contradict some of the studies done so far on the use of L2 tense in production. Studies such as Collins (2004), Ayoun and Salaberry (2008) and Teran (2014) all found evidence for crosslinguistic evidence in tasks such as narrative task, cloze task and a written retell task. Moreover, proficiency

(Bardovi-Harlig, 1992) did not seem to guide the sensitivity to tense, as its addition to the model did not yield any significant results.

As for crosslinguistic influence in online sentence comprehension, the results of the current study showed that L1 learners of L2 English were not able to detect L2 coreference violations in the SPR task. There was also no difference between the groups, which means that the study did not find similar results that were found in Roberts and Liszka (2013). Therefore, the assumption by Roberts and Liska (2013) that grammatical realization of L1 aspect is a prerequisite for L2 present perfect tense to be processed incrementally was not supported. Even after the inclusion of languages that grammaticalize aspect (Croatian and Spanish) and those which do not (German), all three learner groups performed the same. On the other hand, if the presence of present perfect in L1 was a prerequisite for the sensitivity to mismatches in the SPR task, the L1 Spanish group should show some sensitivity—which was not the case. This leads me to conclude that the three factors did not appear to have an effect on L2 incremental processing of English coreference violations.

These findings share some similarities and some differences with previous research on online sentence comprehension. For example, the results go in line with O'Reilly's (2018) findings, who did not show any differences between L1 Croatian and L1 Mandarin learners of L2 English. Yet, the study at hand does not find support for L1 transfer that was recorded in other studies (Chan, 2012), since all three L1 groups performed the same in the AJT and SPR task. Moreover, the realization of aspect did not guide crosslinguistic influence in L2 processing of tense, as was argued to be the case in Roberts and Liszka (2013) which did find sensitivity to mismatches with L1 French learners of English.

This means that the findings did not show L1 crosslinguistic influence and that L2 processing of mismatches was not native-like. The results support that at the grammatical level, crosslinguistic influence is less common, which is visible in the lack of L1 co-activation in any of the groups. The FRH (Lardiere, 2009), as a part of the generative approach to L2 acquisition, argues that the variation in L2 acquisition is due to L1 feature reorganization in order to fit L2 features. In this case Spanish learners were not expected to learn or abandon new features, as Spanish has both past simple tense and a past tense that has current relevance. Therefore, the FRH would predict differences between the L1 Spanish group from other two L1 groups (Croatian and German). However, again, we see no differences between learners. Usage-based approaches, like learned attention, would in this case predict that at least the L1 Spanish group would be sensitive to L2 tense cues, as present perfect tense in Spanish overlaps in form and meaning with the English present perfect. Yet, the results did not support these assumptions.

In terms of L2 processing, the results suggest that L2 learners engage in structurally shallower processing of grammatical information during L2 online processing of tense, which is compatible with the SSH (Clahsen & Felser, 2006). Research so far has shown that it is easier for L2 learners to use pragmatic, semantic, frequency and lexical information (Hopp, 2009; Juffs & Harrington, 1996; Roberts & Felser, 2011), but when it comes to grammatical information, learners seem to have difficulties with integrating the information (Clahsen & Felser, 2006; Dallas & Kaan, 2008). Additionally, the learners also did not perform target-like even in the offline task (AJT), which showed that they lacked grammatical knowledge in order to notice coreference violations.

3.6.6.1. Methodology.

The choice of online method has also been criticized. O'Reilly (2018) mentioned that outlier correction in SPR research is not standardized. Studies range from changing reaction times that fall two standard deviations from the mean into a participant's mean (Hopp, 2020; Roberts & Liszka, 2013) to replacing RTs above 6000 ms (Roberts & Liszka, 2019) with the highest permissible value (i.e., 6000 ms). In the study by Chan (2012) reaction times shorter that 100 ms or longer than 2500 ms were discarded. However, even with a very strict outlier correction, the effects were detectable in some studies (Chan, 2012; Hopp, 2020; Roberts & Liszka, 2013), which means that SPR can show processing costs. Therefore, data cleaning and analysis cannot explain the results of the current study.

3.6.6.2. Limitations.

It is also important to address limitations that might have influenced the results of the study. Participants differed on various levels, even though special care was taken during participant selection. For example, not all students were majoring in English. Since it was difficult to find participants in Spain, any student at the university who had a good command of English was included in the study. English and Croatian participants were all students of English. Moreover, L1 Croatian learners were on average younger than the L1 German and L1 Spanish group, while the L1 German group started learning English the latest of all the groups. Even though only those participants who scored more than 60% on LexTALE were accepted in the study, the L1 Spanish group still had lower scores on English proficiency (i.e., LexTALE) than the other two groups. Yet, the CFT did not show any differences in proficiency. Because we see that there are no differences in L2 processing of tense mismatches between the groups, it is less likely that the choice of participants or proficiency had an effect on the results.

When it comes to offline tasks on L2 English tense knowledge, L1 Croatian and L1 Spanish learners outperformed L1 German learners on the cloze test, even when the scores for present simple were not included. The AJT found that L2 learners were not successful at detecting mismatches in past simple and present perfect. The difference became significant with present perfect mismatches (i.e., the combination of temporal adverbial in past simple and verb in present perfect tense). The results indicate that the learners did not master in which contexts the tenses should be used. Additionally, even when the AJT and the cloze test scores were added to the model which did not yield any significant results. Therefore, the two offline tasks are probably not the reason for the lack of crosslinguistic influence in L2 processing.

3.6.6.3. Conclusion.

To conclude, this study found that L2 English learners were not sensitive to coreference violations in the SPR task, regardless of their L1. Also, there were no difference between learners with different L1s which differ on their realization of tense and aspect. Therefore, Roberts and Liszka's (2013) findings do not go hand in hand with the current results, which means that the findings do not support the claim the L1 aspectual realization affects the processing of L2 English tense. Additionally, grammaticalized tense in the L1 appeared to have no effect on L2 incremental processing, as the presence of present perfect in L1 that has the same form and meaning as English present perfect did not yield sensitivity to mismatches. What is more, factors like proficiency and task type did not seem to affect the results, as L1 effects were found in other studies with the same method (Chan, 2012; Roberts & Liszka, 2013). The results show the same processing (or lack of native-like processing) for all L2 learners in production and comprehension, which advocates for 'shallow' processing specific to L2 learners (Clahsen & Felser, 2006; Dallas & Kaan, 2008; Grüter & Rohde, 2013).

Moreover, the study did not find crosslinguistic influence predicted by the FRH and learned attention (Ellis & Sagarra, 2010a; Lardiere, 2009).

4. Study 3: Grammatical Aspect

4.1. Introduction

Researchers from formal and functional theoretical frameworks have analyzed L2 acquisition of aspect and have concluded that L2 learners find it difficult to acquire tense and aspect (Bardovi-Harlig, 1998; Shirai & Kurono, 1998; Sugaya & Shirai, 2007). Some production studies advocated for the Aspect Hypothesis (AH) (Andersen, 1991; Andersen & Shirai, 1994), i.e. arguing for a similar pattern of acquisition with all low proficiency L2 learners (based on the interaction of lexical verb classes and grammatical tense and aspect), while some studies which supported the AH also found multiple factors that affect the acquisition process (Sugaya & Shirai, 2007). Other studies investigated the production of aspect in L2 and found the effects of proficiency (Domínguez, Arche, & Myles, 2017; Sugaya & Shirai, 2007), task effects (Liszka, 2015; Sugaya & Shirai, 2007) and L1 effects (Chen, 2016; Hawkins & Liszka, 2003; Sugaya & Shirai, 2007).

Following up on the study on tense in Chapter 3, the present study explores possible L1 influence in online L2 processing of aspect. Studies on visual real-time construal of events in production focused on the instantiation of aspect in the first language and how it affected the use of L2 aspect with early L2 learners (Flecken, 2011; Von Stutterheim & Nüse, 2003; von Stutterheim, Nüse, & Murcia-Serra, 2002). The common findings are that learners are guided by the (+/-) grammaticalized aspect of their L1. Further support for L1 effects was received from comprehension studies with late L2 learners on self-paced reading using temporarily ambiguous sentences (Roberts & Liszka, 2016, 2019).

An important eye-tracking study for this research, carried out by Frazier, Carminati, Cook, Majewski, and Rayner (2006), tested monolingual learners of English on their real-time comprehension of aspect. The study found that native speakers of English were led down a garden path (i.e., initial analysis of temporarily ambiguous sentences is incorrect and requires reanalysis) more when the verb was in past simple (*As John hunted the frightened deer escaped through the woods*) that in past progressive (*As John was hunting the frightened deer escaped through the woods*). The explanation for the results was that the verb in past simple and the definite object following it suggest an endpoint which strengthens the initial analysis, which is more difficult to abandon than by using verb in progressive. The same experiment was repeated with German, Dutch and French learners of English in Roberts and

Liszka (2019), this time with a self-paced reading task. The results showed that those learners whose L1 instantiate grammatical aspect (i.e., French), although differently from English, show incremental use of L2 aspect on the verb which affected the further interpretation of temporarily ambiguous sentences. The L1 German group showed no online sensitivity allegedly due to a lack of grammaticalized aspect in their L1, and the L1 Dutch group showed a trend towards sensitivity, but only in the offline task. The offline sensitivity in L1 Dutch learners is explained by the possibility of progressive aspect becoming grammaticalized in Dutch (Roberts & Liszka, 2019).

The aim of the current study is to test the proposal by Roberts and Liszka (2019) with a different constellation of L1s and to test for crosslinguistic influence. The identical online task as in Roberts and Liszka (2019) was used, this time with native speakers of German, Croatian and Spanish who are highly advanced learners of English. Grammatical aspect is realized differently in all three L1s: German lacks grammaticalized aspect, Croatian and Spanish encode the perfective/imperfective distinction, with the addition of Spanish instantiating progressive in two ways: with the use of the imperfective form and with another form reserved only for progressiveness (*estar*+gerund). Therefore, all three L1s differ from L2 English. Out of the three, Spanish has the most similar aspect encoding, because it also realizes progressiveness grammatically.

The study tests if the grammaticalization of progressive aspect in L1 is the prerequisite for L2 learners to use aspect incrementally. Since this study shows a non-target-like use of L2 aspect in online processing and gives evidence for the lack of L1 influence, the results do not support the findings on sentence comprehension reported in Roberts and Liszka (2019) and the findings on sentence production studies with L2 learners (Flecken, 2011; von Stutterheim et al., 2002).

4.2. Tense and Aspect

Aspect and tense give temporal information and can be expressed lexically and/or morphologically in a language. The difference between tense and aspect is the following: tense locates a situation in time in relation to the utterance and aspect looks at the contour of an event (Comrie, 1976), i.e. its beginning, middle and end. Therefore, tense locates an event on a timeline as a past, present or future action. On the other hand, aspect can be divided into grammatical and lexical, which have their own subdivision (see Figure 46). However, in this study only grammatical aspect will be explored, i.e. the realization of aspect morphologically on a verb by the use of affixes.

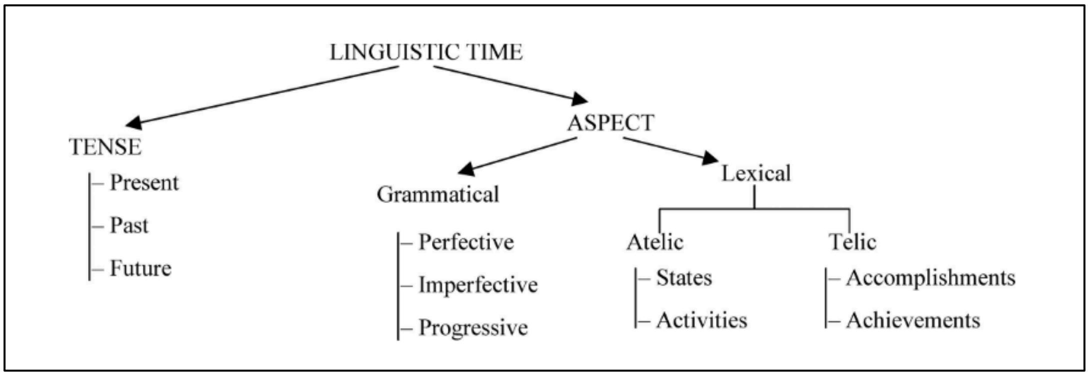

Figure 46. Division of time by tense and aspect (Ayoun & Salaberry, 2008, p. 558)

Aspect differs from tense in that it looks at how the event unfolds (Salaberry & Shirai, 2002), it does not locate an event in time. It is described by Comrie (1976) as the viewpoint of the speaker, who further divides it into (i) an external (outside) point of view and (ii) an internal (inside) point of view. Figure 46 illustrates the division of time according to tense and aspect (Ayoun & Salaberry, 2008), and it shows that aspect can be divided into grammatical and lexical aspect. Firstly, grammatical (viewpoint) aspect will be covered, followed by lexical (inherent) aspect.

The aspectual division to internal and external viewpoint made by Comrie (1976) refers to grammatical (viewpoint) aspect, i.e. seen through grammatical markings on verbs. Aspect can also be explained in terms of boundedness (Depraetere, 1995). The external point of view is also referred to as *perfective* aspect which implies that an event is bounded/completed and that the endpoint is visible. On the other hand, *imperfective* aspect takes the internal point of view, describing situation from the inside, and does not focus on the beginning or the end of an event, but on the internal structure of the process. Imperfective aspect can further be divided into habitual and continuous, and continuous aspect into progressive and nonprogressive. Figure 47 illustrates the division of aspect according to Comrie (1976), with habitual, continuous, progressive and nonprogressive as subcategories of imperfective aspect.

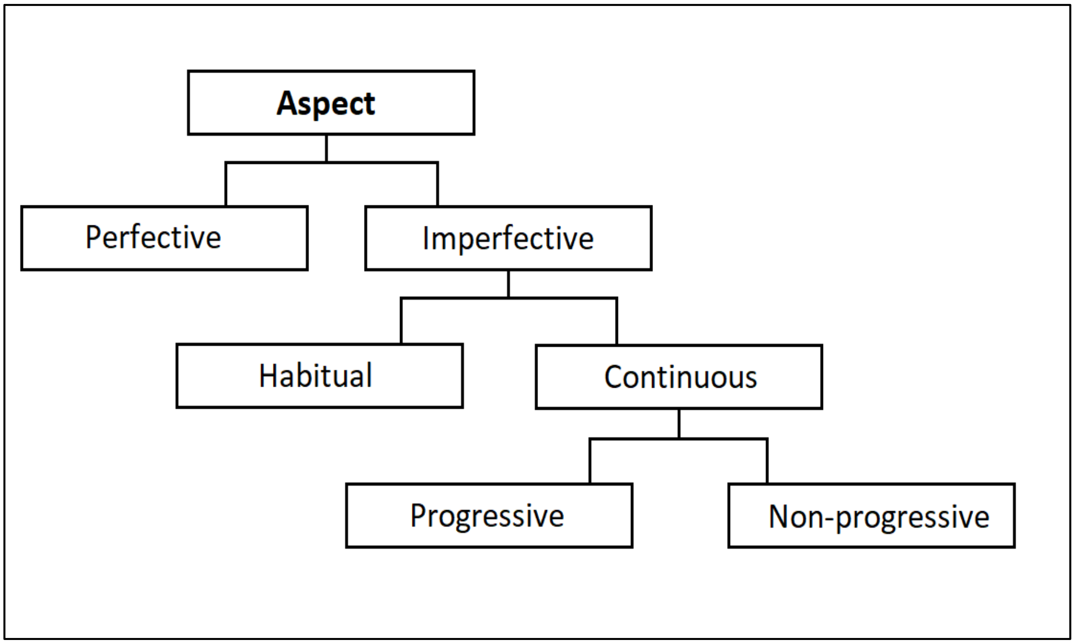

Figure 47. Classification of aspectual oppositions (adapted from Comrie, 1976, p. 25)

Many languages distinguish between perfective and imperfective aspect (Dahl, 1985). However, not all languages grammaticalize all aspects and all sub-categories of the imperfective. For example, English instantiates simple and progressive aspect on verb endings. Simple aspect refers to an event that was completed and has an endpoint (1a) and progressive refers to an event that was ongoing without any signs of completion (1b), i.e. no indication of the endpoint (Comrie, 1976).

(1) a. Kathy ate the cake.
    b. Kathy was eating the cake.

Therefore, English does not grammaticalize imperfective, but only progressiveness by using the inflectional suffix *–ing*. Imperfective aspect also encompasses the habituality of events, i.e. events occurring habitually, usually or by custom. Habituality in English is not expressed morphologically through inflections, but can be expressed through the use of *used to* (2a) or *would* (2b) (Domínguez et al., 2017).

(2) a. I used to go to my grandparents' place every weekend.
    b. I would go to my grandparents' place every weekend.

Moreover, lexical and periphrastic devices can be used to express aspect. For instance, adverbs are used not only to locate the situation on a timeline (e.g., *yesterday*), but also to describe its (aspectual) duration (e.g., *for hours*) in English (3).

(3) He was talking to Ellen for hours yesterday.

Next to grammatical (viewpoint) aspect defined by Comrie (1976) and Ayoun and Salaberry (2008), there is *lexical* (inherent, situational) which is defined as an inherent part of the word or construction that expresses an event (Andersen, 1991). Lexical aspect, also known as *Aktionsart*, describes the actionality of verbs and distinguishes between different internal event structures. In other words, it describes lexical classes of predicates (Ayoun & Salaberry, 2008). Vendler (1967) classified verbs into the following classes: states and events (i.e., activities, accomplishments, achievements). States are conditions that could last a long time indicating no change (4a) and events imply that there will be a change happening through time (Slabakova, 2006). Accordingly, activities have a duration but no inherent goal (4b), accomplishments are activities with an inherent culmination point (4c), and achievements are similar to accomplishments but the change of state is immediate (4d) (Slabakova, 2006).

(4) a. States
My daughter was sick.
b. Activities
I was walking alone.
c. Accomplishments
David painted a picture of my house.
d. Achievements
The girl won the race.

The current study will primarily focus on grammatical aspect, as the materials for the experiments look at grammatical encoding of aspect on verbs and the signaling of boundedness by the use of a specific direct object. What is more, the study at hand focuses primarily on verbs in past and on the use of progressive and simple aspect. The crosslinguistic influence will be analyzed with the use of different L1s in terms of aspect encoding. The next section will investigate studies on L2 production of aspect using offline techniques which will provide a context for L2 aspect acquisition and L1 influence in the process.

4.3. The Production of Aspect in L2 Learners

Studies on the production of L2 aspect revealed that learners tend to use it in a non-target way (Bardovi-Harlig, 1998; Robison, 1995; Shirai & Kurono, 1998; Sugaya & Shirai, 2007). For example, Shirai and Kurono (1998) and Sugaya and Shirai (2007) showed that the imperfective (*te-iru*) in L2 Japanese is more difficult to interpret than perfective aspect. Only some studies addressed the potential L1 effect on the L2 aspect use (Sugaya & Shirai, 2007). Therefore, the majority of studies have mostly focused on the AH (Andersen, 1991; Andersen & Shirai, 1994), which claims that L2 English learners have a tendency to use accomplishment and achievements with simple aspect, but rarely with progressive aspect.

The AH (Andersen, 1991; Andersen & Shirai, 1994) is concerned with the interaction of lexical aspect of a verb with the aspectual morphology in a L2 learner. The AH is based on universals and it does not look at L1 influence, which means that the L2 performance is expected to be the same across L2 learners. The AH argues that, in the acquisition of grammatical aspect, low-proficient learners will use their knowledge of lexical aspect and associate it with a particular grammatical aspect. For instance, past simple is most often associated with telic verbs (*write, fall*), as they denote an event with an endpoint (such as accomplishments and achievements). Progressive is associated with atelic verbs (*love, watch*) as it reflects the ongoing activity or state that does not necessarily have an endpoint (such as activities and states). Based on Andersen's research (1991), the order of acquisition of past perfective in English would be as follows: first achievements, then accomplishments, activities, and states (Andersen & Shirai, 1994; Collins, 2002). Some studies supported the AH regarding the interaction of activities and progressive aspect in oral and written production tasks (Bardovi-Harlig, 1998; Robison, 1995).

Montrul and Slabakova (2003) tested the knowledge of 20 native speakers of Spanish and 64 advanced English learners of Spanish on aspect (i.e., perfective vs. imperfective) split into near-natives, superior and advanced based on the proficiency test and oral interview scores. In other words, the study looked at if the AH affects the acquisition L2 aspect. The authors also aimed at testing (i) the critical period (Johnson & Newport, 1989) for L2 acquisition, i.e. the possibility of reaching ultimate attainment after a certain age, and (ii) how the lack of perfective aspect in L1 English affects the ultimate attainment of L2 Spanish. Sixty-four L1 English learners of Spanish were tested and they ranged from advanced to near-native speakers of Spanish (i.e., advance, superior and near-native) based on written and oral test proficiency. They were tested on their knowledge of aspect in a sentence-conjunction judgment task and a truth-value judgment task, the same one as in White (1995) and Bruhn de Gravito (1997), where they had to judge if the sentence is grammatical or ungrammatical. The sentence-conjunction task (5a and 5b) looked at how the learners judged the use of coordinators *y* ('and') and *pero* ('but') with verbs in preterit and/or imperfect tense (Montrul, 2009, p. 249). The combinations that made sense were called 'logical' (5a), i.e. the combination of imperfect and preterit, and those that did not were 'contradictory' 5b), i.e. the combination of preterit and preterit.

(5) a. Logical

La clase era a las 10 pero empezó a las 10:30.

The class be$_{\text{IMPF}}$ at the 10 but started at the 10:30.

The class was at 10 but started at 10:30.

b. Contradictory

La clase fue a las 10 pero empezó a las 10:30.

The class be$_{\text{PRET}}$ at the 10 but started at the 10:30.

The class was at 10 but started at 10:30.

In the truth-value judgement task learners were instructed to choose if a given sentence, following each story, was true or false. The sentence-conjunction judgment task on semantic interpretation showed that near-native L2 Spanish learners patterned similarly to native speakers of Spanish. The superior group was not as accurate with the use of imperfect (i.e., they mostly used perfective aspect for states), while the advanced group also showed inconsistencies with using imperfect, but with state and achievement verbs. A similar pattern was found in the truth-value judgment task, where advanced leaners did not use perfective and imperfective aspect in a native-like manner, while near-native learners used imperfective aspect with states and activities, and perfective with achievements and accomplishments. The authors interpreted the results as a support for access to UG by L2 learners, however, did not find L1 effects with English learners of Spanish. The authors also mentioned that differences might be found with different L1 groups, but their study only used one sample and can, therefore, not claim the lack of possible crosslinguistic influence.

A study that tested the AH was a study by Sugaya and Shirai (2007) investigating the acquisition of the imperfective marker *te-iru* by L1 English, L1 German, and L1 Slavic (Russian, Ukrainian and Bulgarian) learners of L2 Japanese. German lacks the simple vs. progressive and perfective vs. imperfective distinction, English grammaticalizes progressiveness, while the Slavic languages used in the study instantiate imperfective aspect that encompasses progressiveness. Twenty-one Japanese monolinguals, 39 native speakers of English and 41 learners whose L1s have no obligatory marking specific to progressive (i.e., 18 L1 German and 23 L1 Slavic learners) were tested. Two tasks were employed in investigating the AH and the L1 influence on the acquisition of Japanese imperfective: an acceptability judgment test and an oral picture description task. The acceptability judgement task involved a written dialogue with gaps in the text, the participants were presented with four verb forms to choose from as possible answers. In the oral description tasks, the participants were given two similar pictures that differed in some details (e.g., in one picture a man is smoking and in other the man is talking on the phone). The authors found that, in the acceptability judgement task, L1 learners with a low proficiency in L2 Japanese that have a progressive marker (i.e. English) and those who do not (i.e. German and Slavic languages) associated the imperfective *te-iru* marker with activity verbs. In other words, they used the progressive aspect more with activity verbs. These findings support the AH which advocate for the association between lexical aspect and grammatical aspect. Yet, the oral picture description task showed that those learners whose L1 does not grammatically instantiate progressiveness (i.e. German and Slavic languages) did not show the preference predicted by the AH (i.e., associating imperfective with activity verbs). In sum, even though there was no difference between L2 learners in the acceptability judgement task (only proficiency effects), crosslinguistic effects were found in the oral picture description task.

Liszka (2015) tested five (highly advanced and immersed) L1 French learners of English on a video retelling tasks who were living in London at the time. The study used oral tasks as 'online' tasks and a written task as an 'offline' task. The oral tasks involved using visual stimuli to elicit spontaneous description and the written task required the learners to fill in the gaps of a dialogue by using the appropriate verb form for a verb stem given in parentheses. The focus of the study was on the production of present simple and progressive. The study was a replication of Liszka (2009) with French learners of English who resided in Paris. The results of the original study showed difficulties in matching meaning to form for progressive contexts, meaning that the learners would use both present progressive and present simple in the progressive case. In the more recent study (Liszka, 2015), and similarly to Liszka (2009), participants were observed to fluctuate between the present simple and present progressive in contexts requiring progressive interpretations, with the accurate use of the progressive being around 60% (for the oral production task). Yet, the offline (written) task showed a more target-like use of the progressive in appropriate contexts due to learners, which argued for separate storage of information when it comes to implicit and explicit knowledge (Liszka, 2015). The author argued for a syntactic deficit (Hawkins & Liszka, 2003) that is caused by the lack of the target feature in L1 of L2 learners, and Liszka (2015) points out the differences in results between tasks testing implicit and explicit knowledge.

Dominguez, Arche and Myles (2017) looked at the acquisition of Spanish imperfect by 60 L1 English learners of Spanish, using two oral production tasks and one interpretation task. The learners were divided into three different groups based on their proficiency (beginner, intermediate and advanced). The task used was a description of a series of pictures which illustrated perfective and imperfective events. The participants were also interviewed on their upbringing by being asked questions in preterit and imperfect and were required to do an online sentence-context preference matching text (i.e. rating the appropriateness of a pair of preterit and imperfect sentences). The oral tasks showed an increasing use of imperfect form based on Spanish proficiency, but the form was already seen in use in the beginner's group. The online test showed that the learners incorrectly accepted preterit in the contexts where imperfect is appropriate. Therefore, imperfect is known to learners of all proficiency levels, but is used more accurately as the Spanish proficiency progresses.

To sum up, studies on L2 aspect production found mixed results when it comes to crosslinguistic influence and target-like L2 acquisition of aspect. Even though some studies did not find evidence for crosslinguistic influence (Montrul & Slabakova, 2003; Shirai & Kurono, 1998; Sugaya & Shirai, 2007), multiple factors that affecting the L2 use of aspect, task type and proficiency were discovered. For example, Sugaya and Shirai (2007) found that only those learners whose L1 grammaticalized aspect (i.e., English) were more target-like with the use of aspect, but only in the oral description task. Studies by Hawkins and Liszka (2003) supported the claim that if the L1 lacks the grammatical instantiation of aspect, this would be seen in the nontarget-like use of the L2 aspect in production. Domínguez et al. (2017) also found an effect of proficiency, with higher-proficiency learners being more successful in the use of L2 aspect. An important point made by Liszka (2015) is that the type of tasks affects the results, which was seen in the learners' inability to integrate the L2 information in 'online' tasks (i.e., video retelling tasks), but were more successful in offline tasks (i.e., fill in the gaps). The next section investigates the use of L2 aspect in real-time sentence comprehension.

4.4. The Comprehension of Aspect in L2 Learners

Research on L2 acquisition of aspect gave evidence for crosslinguistic influence (Hawkins & Liszka, 2003; Sugaya & Shirai, 2007), effects of proficiency (Domínguez et al., 2017; Montrul & Slabakova, 2003; Sugaya & Shirai, 2007) and task effects (Sarah Ann Liszka, 2015; Sugaya & Shirai, 2007). Considering that tests designed to test explicit and implicit knowledge of aspect yielded different results (Liszka, 2015), the current section will look at studies designed to test real-time use of grammatical aspect in L2 processing.

A series of studies (Carroll, von Stutterheim, & Nuese, 2004; Von Stutterheim & Nüse, 2003; Von Stutterheim et al., 2002) investigated monolinguals' real-time construal of events and if it was affected by the grammatical realization of L1 aspect. In three studies, Von Stutterheim, Nüse and Murcia-Serra (2002) investigated the construal of events by different L1 speakers, namely, 20 English, 20 German and 20 Spanish, as expressed in the verbalization of events. The hypothesis was the following: based on how tense and aspect are realized in L1, the speakers will emphasize different components of the event for verbalization. For example, because English and Spanish have grammaticalized aspect, the speakers will focus more on the process of an event. However, because German lacks grammaticalized aspect, it will look at events as completed wholes and will focus on the endpoint. In the first experiment, the participants observed a series of eight unrelated computer animations and were required to explain what was happening in individual events (e.g., a boat sinking to the bottom of the sea). The second experiment consisted of analyzing voice time onsets in order to see if there were any differences in the planning processes when the L1 speakers described the scenes. The focus on the endpoint would mean that speakers would wait longer in order to grasp what the endpoint was and then they would start narrating the story. And lastly, the third experiment tested language comprehension. The participants were given a self-paced reading task with temporarily ambiguous sentences, with no punctuation and with a noun phrase that can be interpreted as the possible result of the activity (6) (von Stutterheim et al., 2002, p. 191). The assumption was that German speakers would need an endpoint for a reportable event, which would be a noun in this case, while English and Spanish speakers would not necessarily interpret it as an endpoint, which would be seen in reading differences after the noun phrase *a hole*.

(6) The archeologists went into the cave they started digging a hole was needed since the ground was soggy.

Therefore, the German speakers were expected to interpret the noun phrase *a hole* as a direct object of the clause *they started digging,* since their L1 would condition them to seek an endpoint (i.e., *a hole*) to the activity. English and Spanish learners, however, were not expected to have a preference towards interpreting the noun phrase as the object, since no endpoint is necessary in their L1. The first two experiments on production showed that there was crosslinguistic influence. This was also the case with the third experiment on language comprehension. The reading comprehension experiment found that that German speakers expected an endpoint of the event and showed slowdowns at the verb *was*, which followed the noun phrase (*a hole*). The results of all three experiments confirmed the hypothesis that the grammatical instantiation of aspect affects the way events are construed.

A study by Flecken (2011), among other studies that looked at event construal (Carroll et al., 2004; von Stutterheim & Nüse, 2003; von Stutterheim et al., 2002), investigated how early Dutch-German bilinguals construe events shown in video clips. More precisely, the study looked at if the grammatical encoding of L1 aspect affects how an event is segmented by using eye-tracking. For example, a speaker of a language like German, which does not grammatically instantiate aspect, will focus on the endpoint of an event, while speakers of languages with a progressive or imperfective aspect will focus on the ongoingness of the event (Flecken, 2011). Even though neither German and Dutch have a grammaticalized aspect, Dutch speakers have been increasingly using periphrastic constructions (e.g., *aan het* – ‘on the’, *zitten* – ‘sit to’ and *lopen*+infinitive – ‘walk to’) to express that the action is ongoing. German speakers also use periphrastic means (i.e., *an*, *bei* and *dabei*) to express the ongoingness, but very infrequently (Ebert, 2000). The study tested 19 Dutch monolinguals, 19 German monolinguals and 13 bilinguals who attended a bilingual German-Dutch education program. The participants were required to retell 65 short video clips, each clip 6 seconds in length, while the eye-tracker is tracking their fixations on the screen. The monolinguals were required to describe the video clips in their L1 and bilinguals had to retell the video in both languages. However, in order to reduce memory effects for bilinguals (Flecken, 2011), first the experiment was done in Dutch and four months afterwards it was done in German. The results of the eye-tracking experiment showed that German learners used significantly fewer progressive markers while retelling the videos than Dutch monolinguals. Yet, the bilinguals' use of progressiveness surpassed the use of Dutch monolinguals, especially with the use of *aan het* with motion verbs. The eye-tracking data showed support for bilinguals paying more attention to the ongoingness of the process than monolingual German speakers, by fixating those areas in the videos that show the ongoing process, rather than fixating the agents of the action. The Dutch monolinguals showed a similar pattern as bilinguals, but not as strong (i.e., the fixations to the ongoing process were not as frequent as with bilinguals). The study showed that both Dutch monolinguals and Dutch-German bilinguals showed an increase in the use of aspect when compared to German-Dutch bilinguals, which can indicate that a higher use of aspectual markers in Dutch affects event construal in the L2.

A study by Grüter, Rohde, and Schafer (2017) looked at the influence of L1 discourse-level based information (event structure) on the coreference choices (pronouns) in the L2. The participants were 39 L1 English speakers, 23 advanced L1 Japanese and 25 L1 Korean learners of English who were tested on a story continuation paradigm where the learners were required to provide a written continuation of a discourse (7).

(7) a. perfective
Emily brought a drink to Melissa. (She) _________
b. imperfective
Emily was bringing a drink to Melissa. (She) ______

Even though learners of English showed the connection of aspect and completed events in a 'knowledge-of-the-aspect' task, the same knowledge was not shown in the story continuation paradigm where they had to distinguish between coreference for completed events and ongoing events. English native speakers used event information in production, i.e. sentences with the verb in imperfective required the continuation with the subject. Thus, event structure (perfective and imperfective aspect) in the L2 had less an effect on learners of English than on English native speakers. The results excluded the possibility of crosslinguistic influence considering that both L1 groups performed the same.

As already mentioned, one type of temporary ambiguous sentences are object-subject ambiguities. Object-subject ambiguities, i.e. interpreting the first NP as the direct object of the initial clause, have been tested during reading and listening (Frazier & Rayner, 1982; Kjelgaard & Speer, 1999). In (8), this means that a noun phrase *a mile* is initially interpreted as a direct object of the verb *jogs*, however, the noun phrase is a subject of the following clause (Frazier & Rayner, 1982, p. 179). The preference of interpreting the NP as the object is explained by principles such as Late Closure or Minimal Attachment (Frazier, 1979). The parsing strategy subsumed under Late Closure argues that the incoming lexical items should be attached into the clause/phrase which is currently being processed (Frazier & Rayner, 1982, p. 180). Thus, Late Closure would predict that the noun phrase *a mile* is a constituent of the verb phrase, which is why the phrase is initially interpreted as a direct object of the verb *jogs*. On the other hand, Minimal Attachment argues that the structure which postulates fewer nodes will be preferred in the initial analysis (Frazier & Rayner, 1982). In (9), the noun phrase *the mayor's position* is initially interpreted as an object of the verb *argued*, and not as the subject of a sentential complement, because fewer nodes are used and the structure is simpler (Frazier & Rayner, 1982, p. 180).

(8) Since Jay always jogs a mile seems like a short distance to him

(9) The city council argued the mayor's position was incorrect.

Frazier et al. (2006) conducted a study on English monolinguals' use of aspect in object-subject temporary ambiguous sentences during eye-tracking. The information about the boundedness of an event in English can be expressed not only through aspectual differences on the verb (i.e., past simple vs. past progressive) but also lexically by using a definite or indefinite object. English native speakers were tested on the interpretation of boundedness on the verb and the object affect L1 processing. For example, if an optionally transitive verb *bake* is used without an object (10a), it can denote an episodic interpretation (Frazier et al., 2006) or it can mean that the subject was a baker (i.e., person's occupation). In (10b), the definite NP object creates an endpoint for the verb. A bare plural in (10c) does not provide a clear endpoint and the sentence, therefore, it cannot be interpreted as a bounded event. Thus, the likelihood of interpreting an event as a bounded event is higher when the definite NP object is provided (Frazier et al., 2006). This, however, applies only to verbs that do not have a natural endpoint, like *bake* or *hunt*.

(10) a. Amy baked.
b. Amy baked the cake.
c. Amy baked cakes.

In the progressive, there is no need to add an endpoint to the event because the event denotes an ongoing activity. Therefore, in sentences with a verb in progressive, there is less reason to interpret the following noun phrase as the direct object, as the endpoint is not needed. Frazier et al. (2006) addressed this assumption and tested the online use of information about the boundedness on verbs and objects, and how it affected temporarily ambiguous sentences. Temporary ambiguities in this study were designed to trigger initial misanalysis in readers in sentences like in (11b) and (11d). In both cases *the frightened deer* is the ambiguous NP, and the verb *escaped* following the ambiguous NP will be called a 'critical' region because it is the region where the slowdowns are expected. It is predicted that the NP will be more ambiguous when the verb preceding the NP is in past simple (*hunted*) in (11b) than in past progressive (*was hunting*) in (11d) (Frazier et al., 2006, p. 55). This is because the verb in past simple and the definite object signal boundedness, and the verb in past progressive signals an ongoing activity. The sentences were compared to (11a & 11c) which are not garden-path sentences as they include the pronoun *it* after the noun phrase *the frightened deer* that acts as the subject of the following sentence.

(11) a. Simple past, late closure
As John hunted the frightened deer it escaped through the woods.
b. Simple past, early closure
As John hunted the frightened deer escaped through the woods.

c. Past progressive, late closure

As John was hunting the frightened deer it escaped through the woods.

d. Past progressive, early closure

As John was hunting the frightened deer escaped through the woods.

The predictions of the study are that English native speakers will have more difficulties in processing the past simple early closure (garden-path) sentence with an external point of view than the past progressive early closure (garden-path) sentence during eye-tracking while reading. Thirty-two students in the US were tested, all native speakers of English. The results of the eye-tracking experiment on the critical region (i.e., *escaped*) showed greater processing costs (i.e., longer reading times) for past simple early closure condition compared to past progressive early closure condition, seen in go-past reading data (i.e., reading times from the moment of first entering the region of interest until the rightward movement is launched) (Rayner & Duffy, 1986). Slowdowns were also seen in the past progressive early closure condition, but in the region following the critical region and to a lesser extent. The study confirmed that native speakers of English use aspect on the verb and a direct object to signal boundedness of an even during sentence comprehension.

A study by Roberts and Liszka (2019) was modelled on the study by Frazier et al. (2006), and it looked at interpretive differences of boundedness, but this time with native English speakers and L2 learners of English and by using a SPR task. The learners were all tested on English proficiency and on their offline knowledge of the English aspect. Only the students who scored more than 70% on the cloze test for aspect were considered for the analysis, and the selected groups were matched on their knowledge of aspect and English proficiency. The final list of participants comprised 20 English monolinguals and highly proficient adult L2 learners, i.e. 32 L1 German, 24 L1 Dutch and 24 L1 French learners. In the SPR task, participants were instructed to read sentences in English that were temporarily ambiguous. The sentences were presented in four conditions, namely, in either past simple (12a and 12b) or past progressive (12c and 12d), and they were either early closure (i.e., garden path) (12b and 12d) or late closure (12a and 12c) sentences (Roberts & Liszka, 2019, pp. 20–21). The following sentences illustrate the conditions:

(12) a. Simple past, late closure
As John hunted the frightened rabbit it escaped through the dark trees.
b. Simple past, early closure
As John hunted the frightened rabbit escaped through the dark trees.
c. Past progressive, late closure
As John was hunting the frightened rabbit it escaped through the dark trees.
d. Past progressive, early closure
As John was hunting the frightened rabbit escaped through the dark trees.

The AJT tested students' explicit knowledge of aspect, where the students were asked to rate the sentences on a scale from 1-6 onto how grammatically acceptable they were. The German group rated all early closure sentences as less acceptable, whereas the Dutch and French group rated only past simple early closure items as less acceptable than past progressive early closure items. The offline results indicated that L1 German L2 English learners did not use aspectual information on the verb.

In the SPR task, the English group showed a reduced garden path effect in past progressive compared to past simple in the spillover segment through shorter RTs on the noun phrase (*the frightened rabbit*) which preceded the verb in past simple. This confirmed the findings of the Frazier et al. (2006) study that the object is expected more when it follows the main clause verb in past simple because the native speakers take an external point of view of the situation. As for the L2 learner group, the groups were overall slower at reading early closure sentences than late closure sentences. Yet, French and Dutch learners showed this trend only in the high proficiency group. Very similar effects were found on the spillover segment. However, in the final segment, only the L1 French group showed an interaction of Aspect and sentence Type, which means that they were slower at reading early closure sentences than late closure sentences, but only in the past progressive. Therefore, Roberts and Liszka (2019) replicated the results of the Frazier et al. (2006) with native speakers stating that it is easier to recover from garden path sentences in the progressive, as the endpoint for ongoing events is not necessary. This means that the noun phrase (*the frightened rabbit*) was initially interpreted as the object, but then quickly reanalyzed as the subject of the following clause. Roberts and Liszka's (2019) study showed that all L2 groups were sensitive to boundedness in the past simple condition; however, in the past progressive condition only highly proficient L1 French learners showed an incremental use of aspect. The results between native speakers and L1 French learners of L2 English differed slightly, i.e. it was more difficult for native speakers to recover from late closure in the past progressive. The results showed that crosslinguistic influence can affect the interpretation of boundedness in L2 English sentence comprehension. Considering that French has the imperfective vs. perfective distinction that also encompasses progressiveness and habituality, that knowledge is likely transferred to the L2. Yet, because German instantiates aspect lexically, and not syntactically (as in French), the effect were not visible in offline and online reading comprehension. The L1 Dutch learners of English did not show any effects online, but offline they patterned as the French group, which might be possibly due to increasing use of periphrastic means to express the progressiveness of the event.

Roberts and Liszka (2016) carried out the same study with additional L2 learners (i.e., L1 Spanish and L1 Chinese). The L2 learners included learners whose L1 does not have grammaticalized aspect (18 L1 Dutch and 17 L1 German learners) and L1 with grammaticalized aspect (18 L1 French, 17 L1 Spanish and 19 L1 Chinese learners). The same procedure was applied for the main experiment, and the results showed an immediate effect of early closure for English native speakers in past simple and past progressive on the critical region, but the effect lingered only in the past simple. For the L1 German an L1 Dutch group there was no processing cost between the past simple and past progressive in the early condition conditions. Yet, the groups whose L1s grammaticalize aspect showed different results. On the critical segment all three groups (L1 French, L1 Spanish and L1 Chinese) showed processing costs for garden path sentences in past simple, only the L1 French group showed processing costs for both simple and progressive conditions. In the spillover and until the end, the effect continued, but only for past simple. Yet the effect for past progressive was seen on the final segment for the L1 French and L1 Chinese group. The findings showed that the L1 French, L1 Spanish and L1 Chinese group patterned similarly to English native speakers, i.e. they were sensitive to the aspect of the verb and the definite object. Therefore, the results of the study imply that the L2 sentence comprehension of boundedness is influences by learners' L1 aspect realization.

In sum, research on sentence comprehension has argued for crosslinguistic influence during L2 sentence processing of aspect. Studies on event verbalization confirmed that the grammatical instantiation of aspect in L1 affects the way events are construed in L2 (Flecken, 2011). Studies on monolingual use of aspect to predict the upcoming material in sentence reading showed an incremental use of grammatical aspect (Frazier et al., 2006). The same effect was replicated in L2 English processing of simple vs. progressive aspect, showing that speakers of only those L1s that grammatically instantiate aspect will be able to use L2 English progressive aspect incrementally during reading (Roberts & Liszka, 2016, 2019). Yet, research so far has not systematically manipulated differences in aspect between various languages, which is what this thesis introduces in order to tease apart possible factors for the co-activation of the L1 in the L2. The current paper will address the same question as Roberts and Liszka (2019), testing different L1s that overlap on some, but are different on other aspects. In the continuation, crosslinguistic differences in the realization of aspect between L1s used in this study will be discussed.

4.5. Crosslinguistic Differences in Aspect

The following sections will cover the encoding of aspect in three languages that are crucial for the study at hand. Namely, there are three groups of L2 English learners that differ in the L1: German, Croatian and Spanish. All three languages realize aspect differently, and the first language to be covered in the following is German.

4.5.1. Grammatical aspect in German.

German is a language which lacks morphological ways of encoding aspect (Schilder, 1997, p. 28), but grammaticalized tense. For actions happening in the past *Perfekt* (13a) and *Präteritum* (13b) are used, for present events *Präsens* (13c) and for future events *Futur I* (13d) is used. Both *Perfekt* and *Präteritum* can denote a completed event in the past.

(13) a. Ich habe Angelika gefragt.
I have$_{\text{PRES}}$ Angelika ask$_{\text{PART}}$.
I asked Angelika.
b. Ich fragte Angelika.
I ask$_{\text{PAST}}$ Angelika.
I asked Angelika.

c. Ich frage Angelika.
I ask$_{PRES}$ Angelika.
I ask Angelika.

d. Ich werde Angelika fragen.
I will$_{PRES}$ Angelika ask.
I will ask Angelika.

Aspect it is not grammatically encoded in German, which means that inflectional morphology is not used to signal the perfectivity, imperfectivity or progressiveness. Therefore, mostly lexical means are used for these purposes. For example, a sentence like (14) could have three different meanings, namely, ‘Katharina sang’, ‘Katharina was singing’ and ‘Katharina used to sing’. This means that by using the simple past (*Präteritum*) or compound past (*Perfekt*) form, it is impossible to distinguish between perfectiveness, progressiveness and habituality.

(14) Katharina sang.
Katharina sing$_{PAST}$.
Katharina sang./Katharina was singing./Katharina used to sing.

Even though grammatical means of encoding aspect are not available in German, lexical means are used to make the duration and habituality clear. For example, adverbials such as *während* (‘while/during’) or *immer* (‘always’) can be used to signal progressiveness (15a) and habituality (15b), respectively.

(15) a. Während Katharina sang, putzte sie ihr Zimmer.
While Kaharina sing$_{PAST}$, clean$_{PAST}$ she her room.
While Katharina was signing, she cleaned her room.

b. Ich habe Montags immer Fußball gespielt.
I have Mondays always football played$_{PART}$.
I used to play football on Mondays.

Apart from using adverbials to express aspectual difference, periphrastic means can also be used to express aspect. Comrie (1976) points out that the difference between simple and progressive aspect can be captured by the use of prepositions. For example, in (16a) the verb in *Präteritum* signals that the action is completed, while in (16b) duration of a past event is signaled by using the preposition *im* ('in + the$_{\text{NEUT}}$') in combination with the verb in *Präteritum*.

(16) a. Jan las das Buch.
Jan read$_{\text{PAST}}$ the book.
Jan read the book.
b. Jan las im Buch.
Jan read$_{\text{PAST}}$ in the$_{\text{MASC}}$ book.
Jan was reading the book.

Progressiveness can also be expressed periphrastically with the use of *am* + infinitive *sein* ('to be') (17a) or with the use of adverbial *gerade* ('currently/just') (17b).

(17) a. Ich bin am Arbeiten.
I be$_{\text{PAST}}$ on the$_{\text{FEM}}$ work.
I am working.
b. Ich lese gerade.
I read$_{\text{PRES}}$ currently.
I am currently leaving work.

The periphrastic constructions, however, are not used with all verbs (Comrie, 1976), for instance, they are commonly used with verbs of change. Therefore, it is possible to use adverbials and periphrastic means in German to express the aspectual information of events. Since German does not grammaticalize aspect, the verb cannot not signal the end of a clause through the boundedness of the event. To summarize, German is a language that grammatically instantiates tense, but lacks the grammatical means to realize aspect.

4.5.2. Grammatical aspect in Croatian.

Croatian encodes tense and aspect grammatically. Tense is grammaticalized in the past and the present in Croatian, and it has a rich inflectional morphology – similarly to German. *Perfekt* is used for the events in the past (18a), *prezent* is used for events in the present (18b) and *futur I* is used for events set in the future (18c). *Futur I* is a combination of a verb *want* in present tense and the main verb in the infinitive, therefore, it expresses future events periphrastically.

(18) a. Dragan je pročitao knjigu prošlog tjedna.

Dragan be$_{PREZ}$ read$_{PART}$ book last week.

Dragan read a book last week.

b. Dragan čita knjigu.

Dragan read$_{PREZ}$ book.

Dragan reads a book.

c. Dragan će pročitati knjigu.

Dragan want$_{PREZ}$ read$_{INF}$ book.

Dragan will read a book.

In contrast to German and English, Croatian instantiates aspect grammatically, but only the perfective vs. imperfective distinction. The difference between completed events and events with no visible endpoint are realized through prefixation, suffixation and internal modification (Martinot et al., 2003). For instance, in order to change the interpretation of an event with the verb 'read' (*čitati*) in imperfective to an event with an imperfective interpretation (19a), a prefix *pro–* is added (19b).

(19) a. Antonija je čitala knjigu.

Antonija be$_{PREZ}$ read$_{PART.FEM}$ book.

Antonija was reading a book.

b. Antonija je **pro**čitala knjigu.

Antonija be$_{PREZ}$ read$_{PART.FEM}$ book.

Antonija read a book.

Perfectivity can also be accomplished by using prefixes such as *na–* (20a), *u–* (20b), *po–* (20c) and *ot–* (20d) on the imperfective stem.

(20) a. 'work'

pisati$_{IMPF}$ – **na**pisati$_{PERF}$

b. ‘do’

$raditi_{IMPF}$ – $\mathbf{u}raditi_{PERF}$

c. ‘eat’

$jesti_{IMPF}$ – $\mathbf{po}jesti_{PERF}$

d. ‘sing’

$pjevati_{IMPF}$ - $\mathbf{ot}pjevati_{PERF}$

Another way of signaling aspect is by adding suffixes to the stem of the perfective verb in order to make an event imperfective (Samardžić & Miličević, 2016). Therefore, the addition of suffixes *–va* (21a) or *–ga* (21b) would change a completed event with an endpoint into an ongoing event without a beginning nor an endpoint.

(21) a. sign’

$potpisati_{PERF}$ – $potpisi\mathbf{va}ti_{IMPF}$

b. ‘help’

pomoći$_{PERF}$ – $poma\mathbf{ga}ti_{IMPF}$

Considering that Croatian instantiates the perfective vs. imperfective aspectual distinction, the imperfective allows for both habitual (22a) and progressive (22b) interpretation.

(22) a. Habitual

Obično	sam	čitala	u	knjižnici.
$Usually_{HAB}$	be_{PREZ}	$read_{PAST.FEM}$	in	library.

b. Progressive

Jučer	sam	čitala	u	knjižnici	satima.
Yesterday	be_{PREZ}	$read_{PAST.FEM}$	in	library	for $hours_{PROG}$.

Yesterday I was reading in the library for hours.

However, not all affixes change the meaning of a verb from imperfective to perfective. Some affixes can be used as a derivation to completely change the meaning of the lexeme. In conclusion, Croatian grammaticalizes tense in past and present. Only one tense is used in the past to denote past completed events (*Perfekt*) that is similar in meaning with English past simple. Yet, in terms of grammatical aspect, there is a clear division between perfective and imperfective. Progressiveness is encompassed in imperfectivity, but it is not instantiated separately from imperfective aspect.

4.5.3. Grammatical aspect in Spanish.

Spanish instantiates tense and aspect grammatically. For actions located in the past *pretérito simple* is used (23a), for present *presente simple* (23b) and for future *future perfecto simple* (23c) is used. Therefore, tense is realized grammatically for past, present and future. Spanish also has a rich inflectional system, by adding suffixes for the appropriate person, number and tense.

(23) a. Marina leyó el libro.
Marina read$_{\mathrm{PRET}}$ the book.
Marina read the book.
b. Marina lee el libro.
Marina read$_{\mathrm{PRES}}$ the book.
Marina read the book.
c. Marina leerá el libro.
Marina read$_{\mathrm{FUT}}$ the book.
Marina will read the book.

Aspect in Spanish is grammatically marked on verb inflections and it differentiates between perfective and imperfective events. For instance, preterit (*pretérito perfecto simple*) and imperfect (*pretérito imperfecto simple*) in the past are grammatically encoded, and aside from signaling past events, they also signal aspect (24). *Pretérito perfecto simple* is a simple tense signaling past completed events. *Pretérito imperfecto* is used for imperfective, i.e. progressive and habitual events in the past.

(24) Litò habló/hablaba en Inglés.
Litò speak$_{\mathrm{PRET}}$/speak$_{\mathrm{IMPERF}}$ in English.
Litò spoke/was speaking in English.

Therefore, *pretérito perfecto simple* signals a past completed event (perfective aspect) and *pretérito imperfecto simple* signals incompletion of an event (imperfective aspect) (García Fernández, 1998). The imperfective aspect expresses habitual (25a), intention (25b), generic

(25c) or progressive (25d) meanings (González, 2003; Martínez Atienza, 2004; Montrul, 2004). Generic meaning implies an existential (universal) interpretation of events.

(25) a. Cuando era pequeño jugaba con mi hermano.
When be$_{\text{IMPERF}}$ little play$_{\text{IMPERF}}$ with my brother.
When I was younger I used to play with my brother.

b. Estudiaba para el examen pero me enfermé.
Study$_{\text{IMPERF}}$ for the exam but me got sick.
I studied for the exam, but I got sick.

c. Las mujeres no trabajaban en el siglo XVI.
The women no work$_{\text{IMPERF}}$ in the century XVI.
Women did not work in the XVI century.

d. Bailaba en la disco por una hora cuando recibí una llamada.
Dance$_{\text{IMPERF}}$ in the disco for one hour$_{\text{IMPF}}$ when get$_{\text{IMPERF}}$ a call.
I was dancing in the disco for one hour when I got a call.

Additionally, Spanish has another means of expressing progressiveness, which is through the combination of the verb *estar* (‘to be’) in *pretérito imperfecto simple* (imperfect tense) and the main verb in gerund (26) (Montrul, 2004). This means that through grammatical aspect, Spanish can indicate if the verb requires an endpoint (simple aspect) or not (progressive aspect) that could be accomplished by means of a specific object.

(26) Estaba bailando en la disco cuando recibí una llamada.
Be$_{\text{IMPERF}}$ dance$_{\text{PRET}}$ in the disco when get$_{\text{IMPERF}}$ a call.
I was dancing in the disco when I got a call.

To sum up, Spanish instantiates tense as past, present and future events on a timeline. As for aspect, Spanish grammaticalizes the perfective/imperfective distinction, signaling past completed events and past events with no endpoint, respectively. Imperfective aspect encompasses progressiveness, habituality, generic and universal meaning. Yet, there is an additional grammatical form to express progressiveness, which means that speakers can alternate between *pretérito imperfecto simple* and *estar*+gerund to express an ongoing action.

4.5.4. Summary.

All three languages grammaticalize past tense, but differ from one another in the instantiation of aspect. Table 114 sums up differences between the tense (past/non-past) and aspect realizations (i.e., perfective/imperfective vs. simple/progressive). L2 English is also added to the table because the current study looks at the effects of L1 aspect L2 English processing.

Table 114. Grammatically encoded tense and aspect oppositions across L1s (German, Croatian and Spanish) and L2 (English) in this study

	English	German	Croatian	Spanish
Past/non-past	+	+	+	+
Perfective/imperfective	-	-	+	+
Simple/progressive	+	-	-	+

Aspect is instantiated differently in all languages, with a perfective vs. imperfective distinction in Croatian and Spanish, and with no grammatical encoding of aspect in German. German uses lexical, periphrastic and contextual means to signal progressiveness and habituality. English, on the other hand, morphologically instantiates only the simple vs. progressive distinction. Aside from the imperfective aspect, Spanish has another grammatical means of expressing progressiveness. Other than English and Spanish, none of the languages grammaticalize progressiveness, which is of importance for the current study in order to disentangle which factors affect predictive use of L2 aspect: grammaticalized past tense, grammaticalized aspect or progressive aspect.

According to Roberts and Liszka's (2019) proposal, learners whose languages grammatically encode aspect will be sensitive to event interpretation based on aspectual differences on the verb and the direct object. Alternatively, it could be that only those languages that have one-to-one correspondence of form-meaning, like progressive in Spanish and English, will show sensitivity to event conceptualization. Therefore, the current paper tests Roberts and Liszka's (2019) proposal and to which degree crosslinguistic differences affects L2 processing. The following section describes the current study in more detail, i.e. its research questions, materials, methods and results.

4.6. The Study: Object-Subject Temporary Ambiguities

4.6.1. Overview and research questions.

The study at hand looks at L2 learners' processing of English aspect who differ in their L1 (i.e., German, Croatian and Spanish). It investigates if and how the L1 affects the interpretation of L2 aspect in real time. The study builds on the work by Roberts and Liszka (2019) with learners of different L1s in order to disentangle which factors affect the incremental use of aspect in the L2. The results of Roberts and Liszka (2019) suggest that the grammatical instantiation of aspect in L1 conditions the incremental use of L2 aspect in online processing. Only the native speakers of those L1s that grammatically encoded aspect (i.e. French) showed target-like processing of English aspect. The L1 German group did not show online and offline processing. The L1 Dutch group was successful in using L2 aspect information offline, but did not pattern like English native speakers in real-time. The authors suggest that Dutch learners showed a native-like use of aspect since aspect might be on its way to becoming grammaticalized in Dutch (Flecken, 2011; Roberts & Liszka, 2016).

Studies on the monolingual use of aspect in production (Von Stutterheim & Nüse, 2003; von Stutterheim et al., 2002) and comprehension (Frazier et al., 2006; von Stutterheim et al., 2002) found that the grammatical instantiation of aspect affects the way events are construed. Even though studies on L2 processing of aspect are not numerous, Flecken (2011) found that early bilinguals also use L1 aspectual information for event construal in L2 production. Studies on monolinguals' sentence comprehension show that readers are led by aspectual differences on the verb in their commitment to a direct object (Frazier et al., 2006). Sentence comprehension in L2 learners has shown a slightly different picture (Roberts & Liszka, 2016, 2019), suggesting that L1 grammaticalized aspect (even if instantiated differently form the L2) is a prerequisite for the L2 online use of aspect. The current study aims at testing (i) if L2 learners of English are sensitive to the conceptualization of boundedness expressed in a verb in simple aspect and the direct object, (ii) if the general instantiation of grammaticalized aspect in L1 is necessary for L2 processing, or (iii) if the specific encoding of the progressive aspect in L1 is a prerequisite for online processing of L2 English.

Table 115. Grammatically encoded tense and aspect contrasts across L1s (German, Croatian and Spanish) and L2 (English) in this study.

	L2 English	L1 German	L1 Croatian	L1 Spanish
Past/non-past	+	+	+	+
Perfective/imperfective	-	-	+	+
Progressive/simple	+	-	-	+

Thus, the current study broadens the question of Roberts and Liszka (2019) by introducing the following L1 constellation: L1 German, L1 Croatian and L1 Spanish group. In terms of past tense, all languages have morphological means of expressing a past event, i.e. English – past simple, German – *Perfekt*, Croatian – *perfekt* and Spanish - *pretérito perfecto simple*. When it comes to aspect, only German does not instantiate it grammatically. English encodes the simple vs. progressive distinction, Croatian and Spanish encode the perfective vs. imperfective distinction, but Spanish also has an additional means of instantiating progressiveness. Therefore, only English and Spanish have a specific form for the progressive aspect, which means that they overlap on most of the points. By testing the proposal by Roberts and Liszka (2019), the current study will use object-subject ambiguities to see if learners are guided by the grammatical aspect on verb in their commitment to the object. Table 115 points out crucial differences between languages that will guide the study in making prediction regarding learners' L2 incremental use of English aspect.

The following research questions are posed and the corresponding hypotheses are proposed:

Research question 1: Do L2 learners of English show knowledge of aspectual distinctions in English real-time production?

Hypothesis 1: All learners will show knowledge of English aspect in production.

Research question 2: Do L2 learners of English show knowledge of aspectual distinctions in English comprehension?

Hypothesis 2: Learners will differ in their knowledge of English aspect in comprehension.

Research question 3: Does the presence or absence of grammaticalized aspect in the L1 affect L2 English processing of temporary ambiguities?

Hypothesis 3: L1 Croatian and L1 Spanish learners will show differences in sensitivity to temporary ambiguities between simple and progressive because their L1 realizes aspect grammatically. L1 German learners will show no processing asymmetry because the language lacks grammaticalized aspect.

Research question 4: Does the presence or absence of a specific form for the progressive aspect in the L1 affect L2 English processing of temporary ambiguities?

Hypothesis 4: Only L1 Spanish learners will show sensitivity to temporary ambiguities between simple and progressive because their L1 has a specific grammatical form for expressing progressiveness.

The first question is concerned with the knowledge of aspect in production. Studies on showed mixed results in the use of aspect, but most show proficiency effects (Domínguez et al., 2017; Montrul & Slabakova, 2003; Sugaya & Shirai, 2007). Considering that English learners of this study are students of English and highly advanced in their English skills, the prediction is that all L1 learner groups will show target-like use of L2 aspect information in English.

The second question addresses the use of L2 aspect in online sentence comprehension which will be measured with temporary ambiguities in a self-paced reading task. The current research tests the proposal by Roberts and Liszka (2019), stating that the use of L2 aspectual distinction is conditioned by the L1 instantiation of aspect (Flecken, 2011; Roberts & Liszka, 2016, 2019), which means that Spanish and Croatian learners will show target-like use of L2 aspect. The third question claims that there will be crosslinguistic differences in L2 online processing based on L1 grammatical aspect. I predict that speakers of grammaticalized aspects (i.e., Croatian and Spanish) will use the information incrementally. Croatian and Spanish learners of English are predicted to use aspectual information on the verb in their commitment to the direct object, based on the grammatical encoding of aspect on the verb. This will be seen in a stronger commitment to a direct object interpretation when the verb preceding it is in past simple, as the simple aspect requires an endpoint. Since the L1 German group lacks grammaticalized aspect in their L1, they will not show any difference in the commitment between verbs in progressive and simple.

The fourth question regards the effects of having the progressive-specific form in L1. If the grammatical marking of progressive aspect is the factor in the online use of L2 progressive aspect, then only L1 Spanish learners will show a stronger commitment to the object with verb in past simple due to the fact that Spanish has a grammatical marking for progressiveness. Because Croatian and German lack a grammatical form for the progressive aspect, the learners of those languages will not show native-like processing which would be seen in slowdowns in reading temporary ambiguous sentences.

4.6.2. Participants.

Three groups of L2 English learners were tested: L1 German, L1 Croatian and L1 Spanish. All the participants were tested in their respective countries. They were all university students and were paid a small fee for participating. There were 27 L1 German (M_{AGE} = 24.73, SD_{AGE} = 4.69, range: 19 – 37), 41 L1 Croatian (M_{AGE} = 21.83 years, SD_{AGE} = 2.1, range: 19 – 29 years) and 27 L1 Spanish (M_{AGE} = 24.81, SD_{AGE} = 3.83, range: 20 – 34) learners. Since the study only looked at late bilinguals, this led to excluding one L1 German learner who was an early bilingual. Table 116 summarizes participant information only for those learners that were chosen for the main study.

Table 116. L2 learners' participant information (*N* = 87).

	L1 German (*n* = 24)			L1 Croatian (*n* = 40)			L1 Spanish (*n* = 23)			Between-group analysis
	Mean	Range	*SD*	Mean	Range	*SD*	Mean	Range	*SD*	
Age (in years)	25.17	19 – 37	4.61	21.83	19 – 29	2.1	24.52	20 – 33	3.62	H (2) = 15.52, p < **.001**
Age of acquisition (in years)	9.46	5 – 24	3.62	6.6	2 – 15	2.8	6.39	3 – 10	1.8	H (2) = 17.35, p < **.001**
Years of learning L2	13.67	7 – 22	3.34	14.53	5 – 23	3.84	14.74	2 – 21	4.77	H (2) = 2.6, p = .27
English LexTALE (score/max 100)	83.41	68.75 – 97.5	9.09	84.03	68.75 – 97.5	8.15	72.17	62.5 – 86.25	6.03	H (2) = 26.72, p < **.001**
L1 LexTALE (score/max 100)	92.38	82.5 – 100	4.91	92.28	68.75 – 100	7.77	94.36	84.83 – 100	4.21	-
English CFT (words/minute)	34.46	27 – 45	5.59	33.9	19 – 51	7.21	33.48	22 – 47	7.97	F (2, 84) = 0.12, p = .89
L1 CFT (words/minute)	44.92	29 – 66	9.62	42.2	26 – 55	6.85	48.48	29 – 70	11.02	-

The participants were tested on their knowledge of English using two language proficiency tasks, i.e. LexTALE and the CFT. LexTALE is a 5-minute vocabulary test that was validated for English proficiency through correlations with TOEIC and the Quick Oxford Placement Test (Lemhöfer & Broersma, 2012). The test used 40 existing words in English with different frequencies and 20 non-words, and required participants to press buttons designated for 'yes' and 'no' on the keyboard in order to decide if the word is an existing English word or not. In the L1 version of the test, the same principle was applied. Lemhöfer & Broersma (2012) created the same test for German and Dutch proficiency.

In the current study, the German LexTALE was used for L1 German learners in order to test their L1 proficiency, with the same number of words and nonwords, and the same instructions as the English LexTALE. Because there is no equivalent test to LexTALE in Croatian, I created one by following the guidelines in Lemhöfer & Broersma (2012) (see Study 1 for more detail) As for LexTALE in Spanish, an existing LexTALE by Izura, Cuetos and Brysbaert (2014) was adopted. In this test, instead of using 60 items, 90 words were used with different frequencies based on the SUBTLEX-Esp corpus (Cuetos et al., 2011). The results of all LexTALE tests were calculated and presented on a scale from 1 to 100 percent. Only those who scored above 60% on the English LexTALE were chosen for the study, which would ensure that only the participants who scored above chance on English proficiency were selected. Two German learners, one Croatian and four Spanish learners of English were excluded because they performed at chance on the English LexTALE (i.e., below 60%).

The Category Fluency Task (CFT) measured productive vocabulary and was adapted from Delis, Kaplan, and Kramer (2001). The participants were instructed to name as many items in English per category (animals and furniture) under one minute. The same test was introduced in the learners' L1 and the L2, the only difference was that the instructions were always in the target language. The participants were recorded during the CFT task. The answers were transcribed and only the correct answers were taken into account for the final score.

After following the selection criteria, the participants comprised of 24 L1 German (M_{AGE} = 25.17 years, SD_{AGE} = 4.61, range: 19 – 37 years), 40 L1 Croatian (M_{AGE} = 21.83 years, SD_{AGE} = 2.1, range: 19 – 29 years) and 23 L1 Spanish (M_{AGE} = 24.52 years, SD_{AGE} =

3.62, range: 20 – 33 years) L2 English learners. Table 116 summarizes the participant information and by-group differences. Eighteen L1 German, 40 L1 Croatian, 23 L1 Spanish learners of L2 English were the same as in Study 1, and 19 L1 German, 29 L1 Croatian and 19 L1 Spanish learners of L2 English were the same as in Study 2. Because data on age, age of acquisition and years of learning English displayed a non-normal distribution, a Kruskal–Wallis one-way analysis of variance was employed to analyze a between-group difference. The L1 groups significantly differed in age (H (2) = 15.52, p < **.001**) and the age of acquisition of English (H (2) = 17.35, p < **.001**), but had spent around the same number of years learning English (F (2) = 2.6, p = .27). A Mann-Whitney U test revealed that L1 Croatian learners were on average younger than L1 German (U = 249.5, p < **.001**) and L1 Spanish learners (U = 232.0, p < **.001**). L1 German learners also started learning English a bit later than L1 Croatian (U = 227.0, p < **.001**) and L1 Spanish (U = 97.5, p < **.001**) learners.

The Kruskal-Wallis one-way analysis of variance revealed significant differences in the means for English proficiency between the groups (H (2) = 26.72, p < **.001**). The Mann-Whitney U test was employed due to the non-normal distribution of the data, and revealed differences in means between L1 German and Spanish (U = 461.5 , p = .40), and Croatian and Spanish (U = 115.0, p < **.001**). This means that the L1 Spanish group scored lower (M = 72.17, SD = 6.03, range: 62.5 – 86.25) when compared to the L1 German (M = 83.41, SD = 9.09, range: 68.75 – 97.5) and the L1 Croatian group (M = 84.03, SD = 8.15, range: 68.75 – 97.5). However, the CFT revealed no differences in L2 English fluency between groups (F (2, 84) = 0.12, p < .89). The participants were also tested by using LexTALE and CFT in their L1s. The L1 German group showed a high proficiency in L1 German LexTALE (M = 92.17, SD = 4.91) and the CFT (M = 44.92, SD = 9.62), as well as L1 Croatian LexTALE (M = 92.28, SD = 7.77) and the CFT (M = 42.2, SD = 6.85), and L1 Spanish LexTALE (M = 94.36, SD = 4.21) and the CFT (M = 48.48, SD = 11.02). No group differences were found in L1 proficiency measures. The summary of the results of proficiency is provided in Table 116.

4.6.3. Materials.

4.6.3.1. Main experiment.

The main experiment was a SPR experiment where the task was to read a sentence word-by-word by pressing the space button. The task is also known as a non-cumulative Moving Windows SPR task, because the words are presented in isolation while the rest of the text is displayed as the series of dashes. More on the procedure will be presented in Section 4.6.4.1.

The study was a replication of Roberts and Liszka's study (2019) on aspect and it used the same stimuli. The experiment consisted of 20 experimental sentences in four conditions and 84 fillers. The experimental sentences were always preceded by an introductory sentence which introduced the context of the story (e.g., *The flat was very old and dirty.*), which was later followed by a sentence which consisted of a preposed adjunct clause containing a verb in the past simple (27) or past progressive (28). All the verbs were optionally transitive, followed by a definite singular DP that always consisted of a determiner, adjective and a noun (e.g., *the small kitchen*). The DP was either a subject of a following clause (early closure) or an object of the verb (late closure). In the early closure (27b & 28b), the DP was temporarily ambiguous between the object of the current sentence or the subject of the following one. However, in the late closure (27a & 28a), a pronoun (e.g., *it*) is added right after the DP which clarifies that the DP is the object and the pronoun is the subject of the following clause. The conditions of the experimental items are presented below (27 & 28).

(27) a. Past simple, Late Closure
Even when Joe cleaned the small kitchen it smelled like old rubbish.
b. Past simple, Early Closure
Even when Joe cleaned the small kitchen smelled like old rubbish.
(28) a. Past progressive, Late Closure
Even when Joe was cleaning the small kitchen it smelled like old rubbish.
b. Past progressive, Early Closure
Even when Joe was cleaning the small kitchen smelled like old rubbish.

The early closure sentences are so-called *garden path* sentences because they are temporarily ambiguous. In this case, the ambiguous part is a noun phrase that is preceded by a verb in progressive or simple. Because progressive aspect in English is defined as an internal perspective of the reader, no endpoint is required after the verb (e.g., object). In contrast, past simple signals an external point of view, which means the reader prefers an endpoint, i.e. the verb should be followed by a direct object. Therefore, if readers makes real-time commitments by incrementally using the information of the aspect, they are expected to recover more easily from the garden-path in the past progressive than in the past simple. The difference between early closure and late closure would be a fixed factor called Type, and the difference between the use of past simple and past progressive will be called Aspect.

Twenty-four of the fillers were experimental items for the tense/aspect experiment which was presented in Chapter 3. The filler items also had two sentences, namely, the introductory sentence and the main sentence. The introductory sentence usually started with a subordinating conjunction, e.g. *because, when, although, even though* and *even*. The sentences always referred to the past events by using the past simple tense (e.g., *Because Blake missed his cat too much, he returned from vacation a day earlier. His cat was very happy to see him*). All the experimental and filler items were taken from Roberts and Liszka (2019) (Appendix C: II).

4.6.3.2. Cloze tests.

In order to assess the participants' knowledge of the progressive/simple distinction, all groups were given two cloze tests: one in English and one in their L1 (see Appendix C: I). The cloze test was adopted from Roberts and Liszka (2019) in order to compare the results with the L2 learners in their study. The English cloze test was a short narrative text with 28 gaps where the verb provided in parentheses had to be inserted in its appropriate aspectual form (14 progressive, 14 simple). The example below (29) is a first sentence taken from the English cloze test:

(29) Quite late one evening I _____________ (walk) home alone from college. The wind ________________ (blow) hard and it _______________ (pour) with rain, so there ______________ (be) no one around.

In Roberts and Liszka (2016), only the participants who scored above 70% were selected for the study in order to avoid results that are below chance. Here, however, the threshold was set to 67.86% due to low performance of the L1 Spanish group, which would have eliminated 5 more participants out of 23 that were left.

The L1 cloze test had a different story, but was comparable in terms of the number of verbs that needed to be changed to the correct form based on the context. Before administering them to the participants, the cloze tests were checked by native speakers of the respective languages (Croatian and Spanish) in order to avoid spelling and aspectual mistakes. Considering that Croatian and Spanish have morphological aspectual distinction, the tests aimed at looking at the consistency of aspectual use. As for German, which does not realize grammatical aspect morphologically on the verb, the test was not administered as the use of tenses cannot reveal anything about the aspect.

4.6.4. Procedure.

4.6.4.1. Main experiment.

The main experiment was always performed first, and was later followed by the cloze test and the proficiency tests. The SPR task was constructed in E-Prime (Schneider et al., 2002), and the participants were seated approximately 60cm away from a laptop with a 15.6-inch screen. The sentences for the SPR task were presented as words in isolation and the full stop was always presented right next to the word in order to indicate the end of a sentence. By pressing the space button, the participants decided on the speed of reading the sentences. Before each experimental and filler item, a fixation cross would appear in order to indicate the beginning of the next item. After each experimental item, a yes/no question would follow it, and the participants would have to click a button for 'yes' and a button for 'no' on the keyboard in order to answer the question (e.g., *Was the flat tidy?*). This means that each participants had to answer maximum 20 questions. The questions were comprehension questions and they referred to the truth of the sentence that preceded the experimental item and half of the time they referred to the experimental sentence itself. When the questions were about the experimental items, they referred to the subject of the main close after the critical verb. The whole experiment lasted around 30 minutes.

4.6.4.2. Cloze tests.

The cloze tests were distributed as pen-and-paper tasks. After finishing the main experiment, the participants would complete all the control tasks first in English (i.e., cloze test, LexTALE and CFT), followed by the same tasks, but this time in their L1. The instructions in the English part were given in English, and, in the L1 part, were given in their native language. The cloze test required participants to fill in the gaps of a short story with verbs in the appropriate form. In the English and the Spanish versions verbs were given in the infinitive form and were required to be inserted in the correct tense and aspectual form. In the Croatian cloze test, the participants had to choose between the imperfective and perfective form of the main verb. The reason for this is the fact that in Croatian the past tense is only realized as a compound tense. Leaving two blank lines for the auxiliary and the participle form would be a clue as to which tense should be used. Furthermore, sometimes the aspectual verb pairs are not as straightforward, therefore, the easiest solution was giving both aspectual versions of the verb the participants could choose from.

The L2 English test typically lasted around 5-10 minutes. The English cloze test was followed by proficiency tasks in English (LexTALE and CFT), a questionnaire about their language skills (also performed on the same laptop), the cloze test in the L1 and the follow-up tests in their L1. The cloze task was administered in the L1 with written instructions in the L1, and had equivalent numbers of gaps as the English version. Participants usually needed around 5 minutes for the cloze test in their native language. The scores from the LexTALE and the cloze test were added to the model in order to account for possible differences.

4.6.5. Results.

4.6.5.1. Cloze tests.

The participants could score a maximum of 28 points in each cloze test (14 for progressive and 14 for simple aspect). Following the study by Roberts and Liszka (2019), the scores were calculated and compared as percentages. In the continuation, first the results of the English cloze test will be presented, followed by the cloze tests in participants' L1 (Table 117).

Table 117. L2 learners' scores (%) on English cloze production task (*N* = 87)

	Mean	SD	Range
German	76%	7.88	71% – 96%
Croatian	86%	7.77	75% – 100%
Spanish	79 %	7.64	67% – 92%

The mean accuracy for the English cloze test based on individual groups was lower for the L1 German group (M = 76%) and the L1 Spanish group (M = 79%) when compared to the L1 Croatian group (M = 86%). Table 117 summarizes the descriptives of the cloze test results per group. A one-way Kruskal–Wallis analysis of variance showed between-group differences when it comes to comparing the means of the cloze test by groups (H (2) = 23.22, p < **.001**). A Mann-Whitney U test revealed differences between the L1 German and L1 Croatian (U = 165.0 , p < **.001**), and the L1 Croatian and L1 Spanish group (U = 227.0, p < **.001**). Therefore, the L1 Croatian group outperformed the L1 German and L1 Spanish group. In their L1s, the L1 Croatian and the L1 Spanish learners performed at ceiling.

The results of the English cloze test for L2 learners displayed high knowledge of the aspectual distinction in English. The results were significantly higher in the case of L1 Croatian than L1 Spanish and L1 German learners. The L1 cloze test revealed a consistent and a correct usage of the aspectual markers for the appropriate context for languages that realize aspect grammatically (i.e., Croatian and Spanish).

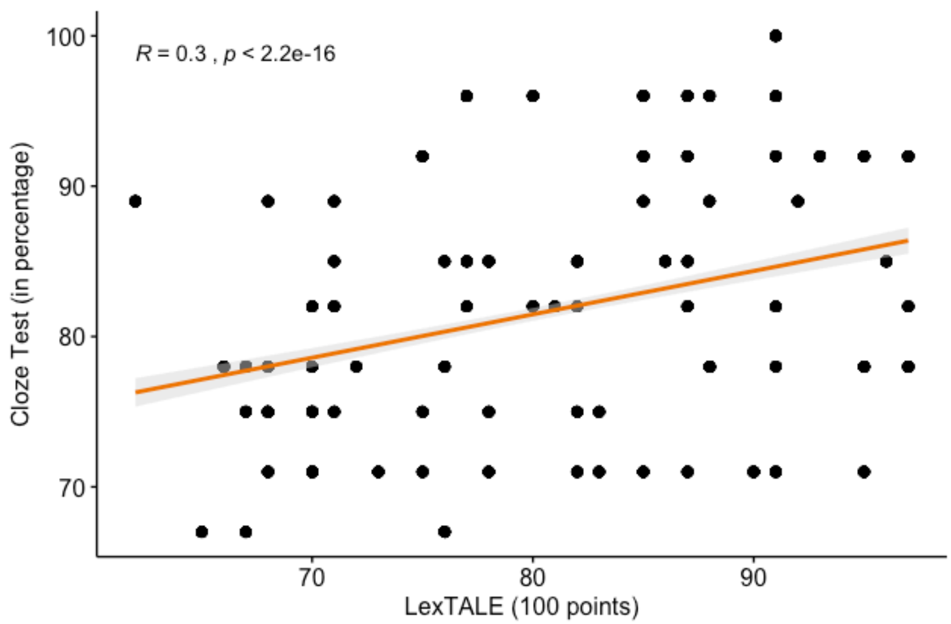

Figure 48. The correlation of the L2 learners' English proficiency (max 100 points) and cloze test (in percentages) results (N = 87)

A Pearson correlation was run on English proficiency (LexTALE) and the knowledge of aspect (English cloze test). The correlation test aimed at looking if the higher English proficiency leads to a better understanding of the use of English aspectual distinctions. The correlation was not done by-group, but was run on the results of all groups combined, and it revealed a moderate positive correlation (r (87) = .3, t = 12.45, p < **.001**) (see Figure 48).

4.6.5.2. Main experiment.

All reading times more than two standard deviations away from the mean reading time of the participant for that segment were replaced by the participant's mean RT. Only those items that were answered correctly were considered for the analysis. The L1 German group had a mean of 88% (*SD* = 34.06), the L1 Croatian 86% (*SD* = 32.89) and the L1 Spanish 86% (*SD* = 34.71) correct answers. A one-way ANOVA did not reveal any significant differences between groups regarding the percentage of accurate responses (F (2, 1737) = 0.52, p = .59).

A linear regression model, i.e. *lmer* function in *lme4* package (Bates et al., 2015), was adopted for the analysis in *R Studio Version 3.4.3* (R Core Team, 2017) with Aspect, Type, Group, Proficiency (LexTALE) and Cloze Test as fixed factors. The model also included the fixed effects' interaction, and the results of the proficiency and cloze test were scaled. Fixed factors were as follows: Aspect referred to the progressive/simple distinction, Type to early/late closure and Group to German/Croatian/Spanish as L1s. Participant and Item were added as random intercepts, and Type and Aspect as random slopes for Participants and Items. The model was run on residual reading times (RTs) on three segments: disambiguation, spillover and final segments; following the same procedure as Roberts and Liszka (2019) in their study.

Because the study is looking at the effects of aspect on reading times of temporary ambiguous sentences, the interaction of interest is between Type and Aspect. The past simple is expected to evoke longer reading times for early closure than for late closure on the segment following the ambiguous noun phrase. This difference in the past progressive should not be statistically visible. Therefore, the Type and Aspect interaction should be detected in the case of past simple with longer RTs for early closure, which was what Roberts and Liszka (2019) found for the L1 French group. The model used treatment coding and used the L1 German group as a baseline, in order to see if learners of an L1 which does not grammaticalize aspect (German) indeed perform differently than L1 Croatian and L1 Spanish learners.

(30) *Even when Joe cleaned the small kitchen it/smelled like old rubbish*.

The experimental items (30) for the analysis were split according to the three regions of interest: disambiguation (*it/smelled*), spillover (*like old*) and final (*rubbish*). Because the study looks at the effects of aspect, the question is if the participants will process the DP (*the small kitchen*) as an object of the verb (*cleaned*) or as a subject of the following clause. Therefore, the disambiguating word was the segment right after the DP, which was the verb (*smelled*) in the early closure condition, and the pronoun and the verb (*it smelled*) in the late closure condition. Because late closure had an additional word (i.e., pronoun *it*) that came after the DP which disambiguated the function of the DP, the subject pronoun (*it*) and the verb (*smelled*) were collapsed into one segments in order to be able to compare the segment which contains the disambiguating verb between early and late closure. The final segment always included only the final word, which was easy to compare across conditions because the number of words were the same. The spillover segment included anything in between the disambiguating and the final segment. This means that across items and conditions the number of words varied, and for this reason the procedure was the same as in the disambiguating segment, i.e. the RTs of the words were collapsed in only one spillover segment. The procedure was exactly the same as in Roberts and Liszka (2019).

4.6.5.2.1. Omnibus analysis.

The first analysis is the omnibus analysis per critical segment. Figure 49 illustrates the mean RTs for the disambiguation, spillover and the final segment for all groups. In the disambiguation and the spillover segment, the RTs for the early closure items seem to be higher than the late closure, regardless of aspect. Even though visually there seems to be a difference between the RTs of simple and progressive early closure, the difference is only around 20 ms for the disambiguation segment and 40 ms for the spillover segment. In the final segment, except for progressive late closure items, all the other conditions pattern similarly. In the following, the results of the model will be presented.

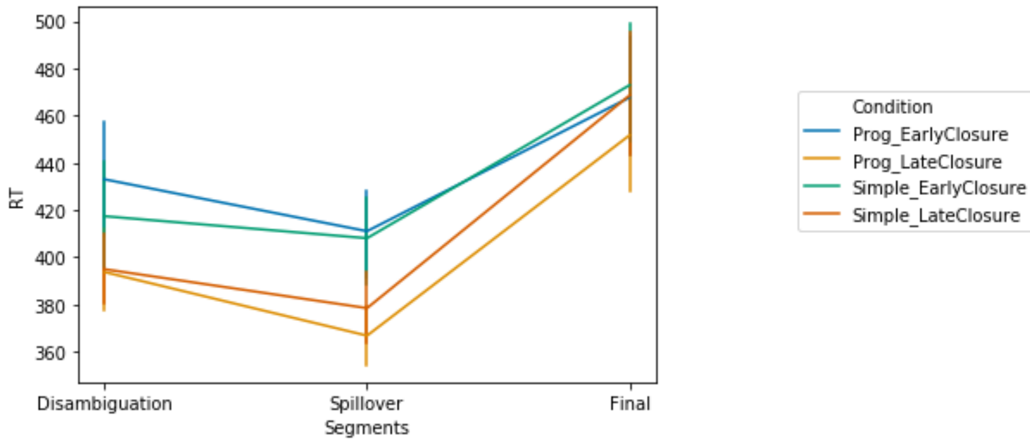

Figure 49. L2 learners' raw reading times (RTs) on the three segments (disambiguation, spillover and final) during SPR in ms (error bars represent the variability of data). All L2 groups (*N* = 87).

The results of the model in Table 118 revealed only a main effect of Type on the disambiguation segment, with higher RTs for the early closure condition. As seen in Figure 49, the participants had higher reading times in the early closure sentences, regardless of aspect. There was only one interaction on the disambiguation segment, which was the interaction between Group:L1 Croatian and Type, which signaled that L1 Croatians acted differently from the L1 German group when it comes to processing early closure sentence. No other interactions were found.

Table 118. Output from linear-mixed effects models run on residual reaction time data for all groups ($N = 87$) combined on the disambiguation segment. The fixed factors included: Group (German, Croatian and Spanish), Aspect (progressive vs. simple), Type (early vs. late closure), Proficiency and Cloze test.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	480.19	47.51	10.11	< .001
GroupCroatian	-78.93	58.28	-1.35	.18
GroupSpanish	21.79	81.95	0.27	.79
Type	-76.30	30.04	-2.54	**.01**
Aspect	-7.87	25.00	-0.32	.75
Proficiency	12.30	39.72	0.31	.76
Cloze test	23.95	42.98	0.56	.58
GroupCroatian*Type	74.76	37.46	2.00	**.05**
GroupSpanish*Type	-10.43	52.45	-0.20	.84
GroupCroatian*Aspect	4.43	31.47	0.14	.89
GroupSpanish*Aspect	-37.57	44.42	-0.85	.40
Type*Aspect	37.22	34.00	1.10	.27
GroupCroatian*Proficiency	-16.40	54.01	-0.30	.76
GroupSpanish*Proficiency	50.59	72.81	0.70	.49
Type*Proficiency	3.80	25.7	0.15	.88
Aspect*Proficiency	18.08	21.69	0.83	.41
GroupCroatian*ClozeTest	-22.56	56.57	-0.40	.69
GroupSpanish*ClozeTest	0.09	62.86	0.00	.99
Type*ClozeTest	-26.27	27.56	-0.95	.34
Aspect*ClozeTest	6.26	22.82	0.27	.78
GroupCroatian*Type*Aspect	-47.84	42.67	-1.12	.26
GroupSpanish*Type*Aspect	3.90	60.07	0.07	.95
GroupCroatian*Type*Proficiency	-20.86	34.87	-0.60	.55
GroupSpanish*Type*Proficiency	-35.35	46.91	-0.75	.45
GroupCroatian*Aspect*Proficiency	-7.92	29.51	-0.27	.79
GroupSpanish*Aspect*Proficiency	-28.19	39.97	-0.71	.48

Type*Aspect*Proficiency	-2.85	29.34	-0.10	.92
GroupCroatian*Type*ClozeTest	0.26	36.34	0.01	.99
GroupSpanish*Type*ClozeTest	7.12	40.66	0.18	.86
GroupCroatian*Aspect*ClozeTest	-14.82	30.56	-0.49	.63
GroupSpanish*Aspect*ClozeTest	-13.78	34.13	-0.40	.69
Type*Aspect*ClozeTest	10.83	31.42	0.35	.73
GroupCroatian*Type*Aspect*Proficiency	7.77	39.77	0.20	.85
GroupSpanish*Type*Aspect*Proficiency	12.16	53.50	0.23	.82
GroupCroatian*Type*Aspect*ClozeTest	5.67	41.60	0.14	.89
GroupSpanish*Type*Aspect*ClozeTest	-0.97	46.09	-0.02	.98

Formula in R: *Disambiguation ~ Group*Type*Aspect*scale(Proficiency) + Group*Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Similarly to the disambiguation segment, the main effect of Type that was highly significant was also found on the spillover segment. This means that the participants read early closure sentences more slowly than the late closure. There was also a marginally significant interaction of Aspect and Cloze Test, which showed that the score of the Cloze Test influenced how they read the past progressive and past simple. There was no interaction between Type and Aspect (Table 119).

Table 119. Output from linear-mixed effects models run on residual reaction time data for all groups (N = 87) combined on the spillover segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	456.35	33.14	13.77	< .001
GroupCroatian	-39.87	39.76	-1.00	.32
GroupSpanish	-40.98	55.85	-0.73	.47
Type	-68.67	21.86	-3.14	**.001**
Aspect	6.91	19.87	0.35	.73
Proficiency	16.72	27.10	0.62	.54
Cloze test	-9.97	29.31	-0.34	.73
GroupCroatian*Type	15.26	26.52	0.58	.57
GroupSpanish*Type	35.93	37.07	0.97	.33
GroupCroatian*Aspect	-23.04	25.03	-0.92	.36
GroupSpanish*Aspect	3.01	35.33	0.09	.93
Type*Aspect	2.39	27.25	0.09	.93
GroupCroatian*Proficiency	-28.60	36.85	-0.78	.44
GroupSpanish*Proficiency	24.69	49.7	0.50	.62
Type*Proficiency	-11.69	18.25	-0.64	.52
Aspect*Proficiency	4.89	17.31	0.28	.78
GroupCroatian*ClozeTest	-20.73	38.61	-0.54	.59
GroupSpanish*ClozeTest	31.08	42.95	0.72	.47
Type*ClozeTest	16.91	19.5	0.87	.39
Aspect*ClozeTest	33.39	18.13	1.84	**.07**
GroupCroatian*Type*Aspect	20.46	34.19	0.60	.55
GroupSpanish*Type*Aspect	21.27	48.14	0.44	.66
GroupCroatian*Type*Proficiency	4.97	24.73	0.20	.84
GroupSpanish*Type*Proficiency	-6.53	33.26	-0.20	.84
GroupCroatian*Aspect*Proficiency	-10.47	23.52	-0.45	.66
GroupSpanish*Aspect*Proficiency	-3.10	31.83	-0.10	.92
Type*Aspect*Proficiency	0.29	23.52	0.01	.99

GroupCroatian*Type*ClozeTest	11.51	25.74	0.45	.66
GroupSpanish*Type*ClozeTest	-21.76	28.87	-0.75	.45
GroupCroatian*Aspect*ClozeTest	-3.86	24.34	-0.16	.87
GroupSpanish*Aspect*ClozeTest	-34.20	27.13	-1.26	.21
Type*Aspect*ClozeTest	-18.27	25.13	-0.73	.47
GroupCroatian*Type*Aspect*Proficiency	37.62	31.88	1.18	.24
GroupSpanish*Type*Aspect*Proficiency	8.34	42.87	0.19	.85
GroupCroatian*Type*Aspect*ClozeTest	-33.66	33.30	-1.01	.31
GroupSpanish*Type*Aspect*ClozeTest	-12.21	36.89	-0.33	.74

Formula in R: *Spillover ~ Group*Type*Aspect*scale(Proficiency) + Group*Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 120 summarizes the results of the analysis on the final segment. The findings on the final segments show an interaction of Group:L1 Spanish, Aspect and Cloze test. The interaction shows that L1 Spanish acted differently to L1 German when it came to aspect processing in English, which was modulated by Cloze Test. There was also an interaction of Group:L1 Spanish, Type, Aspect and Cloze Test.

Table 120. Output from linear-mixed effects models run on residual reaction time data for all groups (N = 87) combined on the final segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	530.26	49.97	10.61	< .001
GroupCroatian	-75.90	61.15	-1.24	.22
GroupSpanish	24.05	85.97	0.28	.78
Type	-45.67	34.01	-1.34	.18
Aspect	-19.66	28.99	-0.68	.50
Proficiency	25.38	41.66	0.61	.54
ClozeTest	20.11	45.04	0.45	.66
GroupCroatian*Type	32.25	42.63	0.76	.45
GroupSpanish*Type	-32.26	59.67	-0.54	.59
GroupCroatian*Aspect	22.32	36.83	0.61	.54
GroupSpanish*Aspect	23.35	52.07	0.45	.65
Type*Aspect	37.79	40.77	0.93	.35
GroupCroatian*Proficiency	-56.25	56.67	-0.99	.32
GroupSpanish*Proficiency	51.55	76.41	0.68	.50
Type*Proficiency	9.13	29.37	0.31	.76
Aspect*Proficiency	18.08	25.32	0.71	.48
GroupCroatian*ClozeTest	-38.87	59.30	-0.66	.51
GroupSpanish*ClozeTest	45.59	65.99	0.69	.49
Type*ClozeTest	3.98	31.37	0.13	.90
Aspect*ClozeTest	8.73	26.67	0.33	.74
GroupCroatian*Type*Aspect	-43.77	51.12	-0.86	.39
GroupSpanish*Type*Aspect	-43.13	72.05	-0.60	.55
GroupCroatian*Type*Proficiency	-9.91	39.73	-0.25	.80
GroupSpanish*Type*Proficiency	-59.80	53.44	-1.12	.26
GroupCroatian*Aspect*Proficiency	7.59	34.48	0.22	.83
GroupSpanish*Aspect*Proficiency	-10.52	46.73	-0.23	.82
Type*Aspect*Proficiency	-11.28	35.23	-0.32	.75

GroupCroatian*Type*ClozeTest	4.48	41.30	0.11	.91
GroupSpanish*Type*ClozeTest	-77.64	46.30	-1.68	.10
GroupCroatian*Aspect*ClozeTest	0.42	35.67	0.01	.99
GroupSpanish*Aspect*ClozeTest	-101.83	39.90	-2.55	**.01**
Type*Aspect*ClozeTest	-0.34	37.47	-0.01	.99
GroupCroatian*Type*Aspect*Proficiency	18.25	47.71	0.38	.70
GroupSpanish*Type*Aspect*Proficiency	-21.21	64.14	-0.33	.74
GroupCroatian*Type*Aspect*ClozeTest	20.20	49.71	0.41	.68
GroupSpanish*Type*Aspect*ClozeTest	130.61	55.04	2.37	**.02**

Formula in R: *Final ~ Group*Type*Aspect*scale(Proficiency) + Group*Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

The omnibus analysis revealed that there was an effect of Type on the disambiguation and spillover segment, which was seen in longer RTs for the early closure than the late closure items. The disambiguation segment also revealed a marginal interaction of Group:L1 Croatian and Type indicating that the L1 Croatian group acted differently compared to the L1 German group. The spillover segment showed a marginal interaction of Aspect and Cloze test which will be analyzed further in the median split analysis according to the cloze test. The final segments found significant interactions of Group:L1 Spanish, Aspect and Cloze test; and Group:L1 Spanish, Type, Aspect and Cloze Test; which will be explored in more detail in the by-group and median cloze test split analyses.

4.6.5.2.2. Omnibus analysis: Cloze test split.

Because there was an interaction between Cloze Test and Aspect on the spillover segment; and Group, Type, Aspect and Cloze test on the final segment, I will look at how RTs were affected by the Cloze Test score of the participants. This will be done by dividing participants according to what their scores were on the test. A median split was used in order to divide the participants into two groups, i.e. every participant who scored below the overall median made up a so-called *low aspect awareness* group, and everyone above the median was in the *high aspect awareness* group. The linear mixed effects model was the same as for the omnibus analysis, only the cloze test was omitted as a fixed factor. First, the results of the RTs by each segment will be presented for the low aspect awareness group and later for the high aspect awareness group.

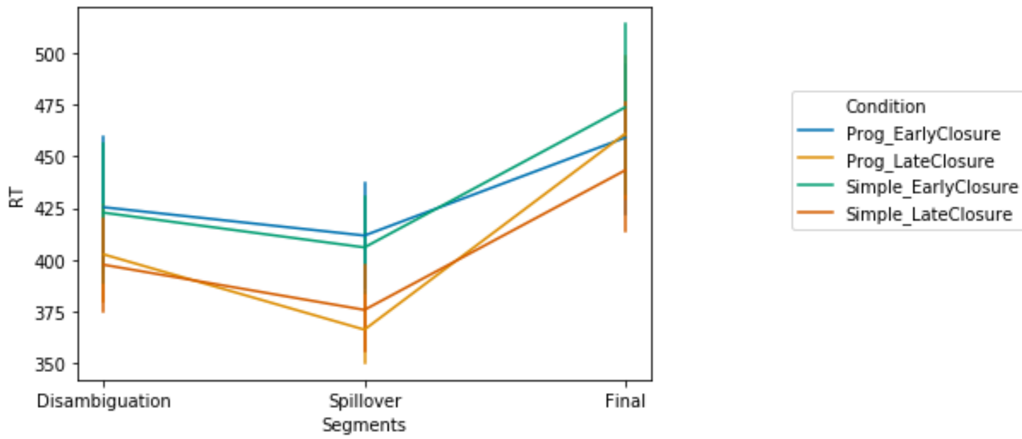

Figure 50. L2 learners' RTs on the three segments during SPR in ms (error bars represent the variability of data) for the low aspect awareness group: L1 German (*n* = 16), L1 Croatian (*n* = 14), L1 Spanish (*n* = 14).

The low aspect awareness group consisted of 44 participants. Figure 50 shows effect of Type on the disambiguation segment which becomes even bigger on the spillover segment. On the final segment, the lines almost overlap which could indicate that there is no significant difference. Even though in Figure 50 there seems to be a difference between the early and late closure conditions on the disambiguation segment, the linear model found only a marginally significant difference of Type. Overall, the low aspect awareness group did not show any significance for main effects nor interactions on the disambiguation segment (Table 121).

Table 121. Output from linear-mixed effects models run on residual reaction time data for low aspect awareness group (n = 44) on the disambiguation segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	453.89	45.32	10.02	< .001
GroupCroatian	-55.92	63.64	-0.88	.38
GroupSpanish	2.06	87.80	0.02	.98
Type	-51.25	28.90	-1.77	**.08**
Aspect	-13.48	24.83	-0.54	.59
Proficiency	35.07	40.25	0.87	.39
GroupCroatian*Type	53.79	41.09	1.31	.19
GroupSpanish*Type	-13.76	57.58	-0.24	.81
GroupCroatian*Aspect	9.04	36.15	0.25	.80
GroupSpanish*Aspect	-37.06	49.54	-0.75	.46
Type*Aspect	15.37	33.82	0.45	.65
GroupCroatian*Proficiency	-48.44	63.99	-0.76	.45
GroupSpanish*Proficiency	30.06	89.59	0.34	.74
Type*Proficiency	-9.94	26.17	-0.38	.70
Aspect*Proficiency	14.50	22.38	0.65	.52
GroupCroatian*Type*Aspect	-12.52	48.94	-0.26	.80
GroupSpanish*Type*Aspect	24.96	67.96	0.37	.71
GroupCroatian*Type*Proficiency	-35.16	41.52	-0.85	.40
GroupSpanish*Type*Proficiency	-27.27	58.53	-0.47	.64
GroupCroatian*Aspect*Proficiency	-14.96	35.79	-0.42	.68
GroupSpanish*Aspect*Proficiency	-36.66	50.58	-0.73	.47
Type*Aspect*Proficiency	7.11	31.05	0.23	.82
GroupCroatian*Type*Aspect*Proficiency	35.95	49.01	0.73	.46
GroupSpanish*Type*Aspect*Proficiency	2.52	69.38	0.04	.97

Formula in R: *Disambiguation ~ Group*Type*Aspect*scale(Proficiency) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Similarly to the disambiguation segment, the spillover segment shows a clear difference in the RTs between the early and late condition. This was also confirmed by a main effect of Type, again, with higher RTs for the early closure sentences. No other effects were detected in the spillover segment (Table 122).

Table 122. Output from linear-mixed effects models run on residual reaction time data for low aspect awareness group (n = 44) on the spillover segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	450.82	34.25	13.16	< .001
GroupCroatian	-9.22	47.22	-0.20	.85
GroupSpanish	-72.50	65.09	-1.11	.27
Type	-76.11	22.94	-3.32	**.001**
Aspect	-18.72	22.41	-0.84	.41
Proficiency	31.76	29.80	1.07	.29
GroupCroatian*Type	-1.36	32.35	-0.04	.97
GroupSpanish*Type	57.44	45.58	1.26	.21
GroupCroatian*Aspect	-21.83	32.35	-0.68	.50
GroupSpanish*Aspect	9.63	44.25	0.22	.83
Type*Aspect	10.22	28.77	0.36	.72
GroupCroatian*Proficiency	-66.75	47.44	-1.41	.17
GroupSpanish*Proficiency	9.51	66.34	0.14	.89
Type*Proficiency	-18.01	20.64	-0.87	.38
Aspect*Proficiency	8.47	20.07	0.42	.67
GroupCroatian*Type*Aspect	37.67	41.67	0.90	.37
GroupSpanish*Type*Aspect	18.88	57.84	0.33	.74
GroupCroatian*Type*Proficiency	9.56	32.68	0.29	.77
GroupSpanish*Type*Proficiency	2.95	46.00	0.06	.95
GroupCroatian*Aspect*Proficiency	-2.07	32.07	-0.06	.95
GroupSpanish*Aspect*Proficiency	-23.88	45.19	-0.53	.60
Type*Aspect*Proficiency	-1.79	26.42	-0.07	.95
GroupCroatian*Type*Aspect*Proficiency	34.11	41.73	0.82	.41
GroupSpanish*Type*Aspect*Proficiency	1.61	59.06	0.03	.98

Formula in R: *Spillover ~ Group*Type*Aspect*scale(Proficiency) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

The results of the final segment showed a main effect of Group:L1 Spanish and two interactions: Group:L1 Spanish, Type and Aspect; and Group: L1 Spanish, Type and Proficiency. A marginal interaction of Group, Type and Aspect indicates that the L1 German group differed from the L1 Spanish group in their processing of early and late closure items between past simple and past progressive. The Group, Type and Proficiency interaction also showed marginal significance, which means that L1 German and L1 Spanish learners differed in the processing of early and late closure, based on how they scored on the proficiency test. Because the interaction of interest (Type and Aspect) in this study was recorded on the final segment with the L1 Spanish group, after the analysis of the high aspect awareness group, each L1 group will be analyzed individually.

Table 123. Output from linear-mixed effects models run on residual reaction time data for low aspect awareness group (n = 44) on the final segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	494.66	53.81	9.19	< .001
GroupCroatian	-31.80	75.21	-0.42	.67
GroupSpanish	13.71	103.82	0.13	**.09**
Type	-46.52	34.95	-1.33	.19
Aspect	-27.23	28.97	-0.94	.35
Proficiency	48.20	47.59	1.01	.32
GroupCroatian*Type	22.51	49.88	0.45	.65
GroupSpanish*Type	-34.99	70.37	-0.50	.62
GroupCroatian*Aspect	5.40	42.36	0.13	.90
GroupSpanish*Aspect	94.64	58.15	1.63	.10
Type*Aspect	24.52	40.08	0.61	.54
GroupCroatian*Proficiency	-94.82	75.62	-1.25	.22
GroupSpanish*Proficiency	71.89	105.89	0.68	.50
Type*Proficiency	5.87	32.08	0.18	.86
Aspect*Proficiency	13.24	26.23	0.51	.61
GroupCroatian*Type*Aspect	-1.60	58.12	-0.03	.98
GroupSpanish*Type*Aspect	-144.02	80.68	-1.79	**.07**
GroupCroatian*Type*Proficiency	-1.96	50.49	-0.04	.97
GroupSpanish*Type*Proficiency	-123.39	71.1	-1.74	**.09**
GroupCroatian*Aspect*Proficiency	1.04	41.92	0.03	.98
GroupSpanish*Aspect*Proficiency	15.70	59.39	0.26	.79
Type*Aspect*Proficiency	3.81	36.92	0.10	.92
GroupCroatian*Type*Aspect*Proficiency	9.45	58.21	0.16	.87
GroupSpanish*Type*Aspect*Proficiency	-87.55	82.58	-1.06z	.29

Formula in R: *Final ~ Group*Type*Aspect*scale(Proficiency) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Figure 51 illustrates the RTs of the critical segments for the high aspect awareness group. There were 43 participants in the group and the model used the same fixed factors and random effects as for the low proficiency group. Figure 51 shows slightly longer RTs for past progressive early closure items than other conditions on the disambiguation segment, however, the difference is around 30 ms. The spillover segments seems to show the same effects of Type, i.e. longer RTs for early and shorter RTs for late closure. The final segment shows no difference between the early closure items, but longer RTs for the past simple late closure items, than the past progressive late closure items. However, the linear mixed effects model found no main effects nor interactions for the disambiguation segment (Table 124).

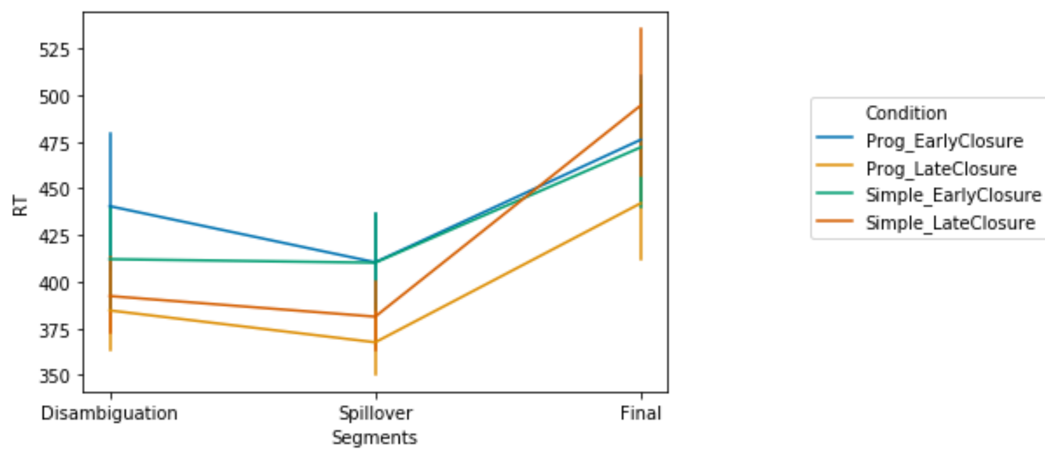

Figure 51. L2 learners' reading times (RTs) on the three segments during SPR in ms (error bars represent the variability of data) for the high aspect awareness group: L1 German (*n* = 8), L1 Croatian (*n* = 26), L1 Spanish (*n* = 9).

Table 124. Output from linear-mixed effects models run on residual reaction time data for high aspect awareness group (n = 43) on the disambiguation segment.

	Estimate	SE	t-value	p-value
(Intercept)	438.40	95.70	4.58	.76
GroupCroatian	-32.41	104.42	-0.31	.43
GroupSpanish	125.07	156.45	0.80	.35
Type	-60.37	64.12	-0.94	.93
Aspect	4.14	49.24	0.08	.11
Proficiency	-227.66	137.56	-1.66	.72
GroupCroatian*Type	25.09	70.45	0.36	.60
GroupSpanish*Type	-53.84	102.93	-0.52	.71
GroupCroatian*Aspect	-19.98	54.53	-0.37	.64
GroupSpanish*Aspect	-39.38	83.10	-0.47	.36
Type*Aspect	60.04	65.97	0.91	.12
GroupCroatian*Proficiency	230.89	146.16	1.58	.10
GroupSpanish*Proficiency	278.37	161.85	1.72	.14
Type*Proficiency	139.23	92.82	1.50	.30
Aspect*Proficiency	78.45	75.5	1.04	.44
GroupCroatian*Type*Aspect	-56.42	72.74	-0.78	.89
GroupSpanish*Type*Aspect	-15.13	108.47	-0.14	.15
GroupCroatian*Type*Proficiency	-142.28	98.36	-1.45	.13
GroupSpanish*Type*Proficiency	-167.32	109.04	-1.54	.42
GroupCroatian*Aspect*Proficiency	-64.54	79.16	-0.82	.34
GroupSpanish*Aspect*Proficiency	-84.99	89.04	-0.96	.29
Type*Aspect*Proficiency	-104.11	98.86	-1.05	.36
GroupCroatian*Type*Aspect*Proficiency	94.60	104.11	0.91	.27
GroupSpanish*Type*Aspect*Proficiency	128.41	115.47	1.11	.76

Formula in R: *Disambiguation ~ Group*Type*Aspect*scale(Proficiency) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

The spillover segment (Table 125) revealed a marginal effect of Type, which means that the early closure items were more difficult to process by all participants. The main effect of Proficiency revealed that low proficient learners of English read the sentences faster. There was an interaction of Group:L1 Croatian and Proficiency; and Group:L1 Spanish and Proficiency. The interactions show that L1 Spanish and L1 Croatian learners differ for L1 German learners that scored high on proficiency, as the L1 German learners with a higher knowledge of English read the sentences more slowly. Other interactions included Type and Proficiency; Group:L1 Croatian, Type and Proficiency; and Group:L1 Spanish, Type and Proficiency. However, there was no Type and Aspect interaction found on the spillover segment for the high aspect awareness group.

Table 125. Output from linear-mixed effects models run on residual reaction time data for high aspect awareness group (n = 43) on the spillover segment.

	Estimate	SE	t-value	p-value
(Intercept)	455.35	54.54	8.35	< .001
GroupCroatian	-87.39	58.95	-1.48	.15
GroupSpanish	13.58	88.13	0.15	.88
Type	-66.52	34.73	-1.92	**.06**
Aspect	19.00	32.91	0.58	.56
Proficiency	-174.48	77.66	-2.25	**.03**
GroupCroatian*Type	51.96	37.49	1.39	.17
GroupSpanish*Type	12.38	54.03	0.23	.82
GroupCroatian*Aspect	2.83	36.60	0.08	.94
GroupSpanish*Aspect	24.55	56.02	0.44	.66
Type*Aspect	26.18	47.11	0.56	.58
GroupCroatian*Proficiency	189.39	82.44	2.30	**.03**
GroupSpanish*Proficiency	214.58	91.51	2.35	**.03**
Type*Proficiency	97.54	49.78	1.96	**.05**
Aspect*Proficiency	7.25	52.22	0.14	.89
GroupCroatian*Type*Aspect	-54.33	51.93	-1.05	.30
GroupSpanish*Type*Aspect	-4.97	77.72	-0.06	.95
GroupCroatian*Type*Proficiency	-110.05	52.60	-2.09	**.04**
GroupSpanish*Type*Proficiency	-120.71	58.44	-2.07	**.04**
GroupCroatian*Aspect*Proficiency	-31.72	54.24	-0.59	.56
GroupSpanish*Aspect*Proficiency	4.13	61.41	0.07	.95
Type*Aspect*Proficiency	7.20	71.56	0.10	.92
GroupCroatian*Type*Aspect*Proficiency	38.31	75.05	0.51	.61
GroupSpanish*Type*Aspect*Proficiency	3.40	83.39	0.04	.97

Formula in R: *Spillover ~ Group*Type*Aspect*scale(Proficiency) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 126 summarizes the results of the linear mixed effects model on the final segment for the high aspect awareness group. The results show a marginal interaction of Group:L1 Croatian, Type, Aspect and Proficiency, showing that Proficiency influences how fast certain conditions are read and that there is a difference between German and Croatian learners. Aside from the mentioned marginal significance, no more results reached the significance level.

Table 126. Output from linear-mixed effects models run on residual reaction time data for high aspect awareness group (n = 43) on the final segment.

	Estimate	SE	t-value	p-value
(Intercept)	540.19	83.96	6.43	.001
GroupCroatian	-111.66	91.45	-1.22	.23
GroupSpanish	54.13	137.20	0.40	.70
Type	-61.65	62.46	-0.99	.33
Aspect	-3.14	58.14	-0.05	.96
Proficiency	-184.13	120.5	-1.53	.14
GroupCroatian*Type	65.25	68.93	0.95	.35
GroupSpanish*Type	22.06	99.67	0.22	.83
GroupCroatian*Aspect	31.66	64.22	0.49	.62
GroupSpanish*Aspect	-58.40	97.67	-0.60	.55
Type*Aspect	60.98	79.86	0.76	.45
GroupCroatian*Proficiency	162.58	128.07	1.27	.21
GroupSpanish*Proficiency	205.21	142.02	1.45	.16
Type*Proficiency	64.65	91.22	0.71	.48
Aspect*Proficiency	57.24	87.46	0.65	.51
GroupCroatian*Type*Aspect	-79.43	88.14	-0.90	.37
GroupSpanish*Type*Aspect	64.78	130.88	0.50	.62
GroupCroatian*Type*Proficiency	-73.19	96.51	-0.76	.45
GroupSpanish*Type*Proficiency	-61.56	107.09	-0.58	.57
GroupCroatian*Aspect*Proficiency	-33.82	92.13	-0.37	.71
GroupSpanish*Aspect*Proficiency	-94.22	103.35	-0.91	.36
Type*Aspect*Proficiency	-189.95	121.71	-1.56	.12
GroupCroatian*Type*Aspect*Proficiency	217.36	127.38	1.71	**.09**
GroupSpanish*Type*Aspect*Proficiency	230.55	141.69	1.63	.10

Formula in R: *Final ~ Group*Type*Aspect*scale(Proficiency) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

To sum up, the models run on the critical segments for the high aspect awareness group showed no significant results for the disambiguation segment. There was a marginally significant main effect of Type and Proficiency. The effect of Type is shown in slower reading times for the early closure items of the low aspect awareness group. The spillover segment also revealed various interactions, including: Group:L1 Croatian and Proficiency; Group:L1 Spanish and Proficiency; Type and Proficiency; Group:L1 Croatian, Type and Proficiency; and Group:L1 Spanish, Type and Proficiency. Even though many fixed effects interacted, there was no critical interaction of Type and Aspect for any of the groups. However, the final segment revealed a marginally significant interaction of Group:L1 Croatian, Type, Aspect and Proficiency. The following analyses will look at each L1 group individually.

4.6.5.2.3. By-group analysis.

Because the model on all groups revealed interactions with Group, the same analysis was also run on groups separately. Table 127 gives the descriptives for the RTs of each group, for each critical segment and for each condition. The table includes the mean value and the standard deviation (in parentheses).

Table 127. Raw reading times in ms (and their SD) of the critical segments (disambiguation, spillover, final) per condition and per L1 group

		Disambiguation *it/smelled*	Spillover *like old*	Final *rubbish*
L1 German	PS_LC	434 (173)	387 (122)	498 (274)
	PS_EC	461 (279)	455 (198)	507 (268)
	PP_LC	415 (150)	389 (124)	484 (244)
	PP_EC	472 (260)	467 (193)	529 (276)
L1 Croatian	PS_LC	379 (132)	366 (124)	455 (254)
	PS_EC	398 (195)	396 (154)	449 (197)
	PP_LC	382 (165)	356 (123)	427 (208)
	PP_EC	407 (213)	397 (190)	432 (207)
L1 Spanish	PS_LC	380 (144)	388 (176)	460 (244)
	PS_EC	403 (184)	378 (151)	477 (309)
	PP_LC	389 (171)	360 (133)	461 (248)
	PP_EC	433 (235)	371 (143)	459 (281)

The linear mixed effects model run on each sample group included Type, Aspect, Proficiency, and Cloze test as fixed factors; Participant and Item as random intercepts; and Aspect and Type as random slopes for Participants. The first group that will be presented is the L1 German group, followed by L1 Croatian and then L1 Spanish. Figure 52 illustrates raw reading times of the critical segments for German native speakers. As it could be seen in the figure, the effect of Type seems to be constant across segments. However, the spillover shows the biggest difference between the early and late closure items, with late closure items evoking shorter RTs. The difference is visible in the disambiguation segment, but it seems to slowly disappear in the final segment.

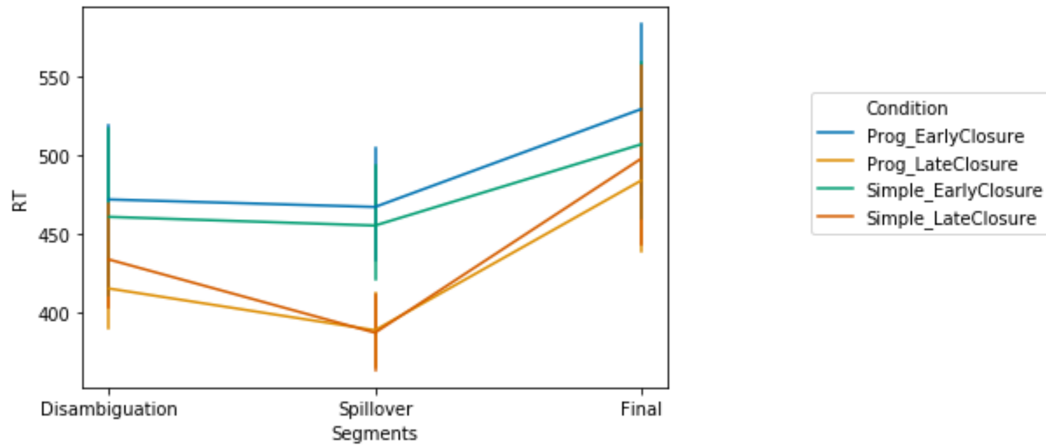

Figure 52. L1 German L2 learners' reading times (RTs) on the three segments during SPR in ms (error bars represent the variability of data) (n = 24).

Table 128 outlines the results of the model for the L1 German group on the disambiguation segment. The results show only a marginal significance of Type, which was also visible in Figure 52. The rest of the results reached no significant difference.

Table 128. Output from linear-mixed effects models run on residual reaction time data for L1 German group (n = 24) on the disambiguation segment.

	Estimate	SE	t-value	p-value
(Intercept)	470.23	45.05	10.44	< .001
Type	-59.01	29.20	-2.02	**.05**
Aspect	-5.34	24.37	-0.22	.83
Proficiency	13.33	44.30	0.30	.77
ClozeTest	24.77	44.72	0.55	.59
Type*Aspect	28.12	29.14	0.97	.34
Type*Proficiency	2.41	28.80	0.08	.93
Aspect*Proficiency	15.54	23.18	0.67	.50
Type*ClozeTest	-27.80	28.87	-0.96	.34
Aspect*ClozeTest	6.53	22.46	0.29	.77
Type*Aspect*Proficiency	-1.92	30.23	-0.06	.95
Type*Aspect*ClozeTest	7.17	30.40	0.24	.81

Formula in R: *Disambiguation ~ Type*Aspect*scale(Proficiency) + Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

A main effect of Type was found on the spillover segment, which is supported by longer RTs for the late closure items. The interaction between Aspect and Cloze test came up as marginally significant. This means that learners who were better in Cloze test read the progressive and simple aspect differently. Similarly to the disambiguation segment, there were no more significant results, which also excludes the Type and Aspect interaction (Table 129).

Table 129. Output from linear-mixed effects models run on residual reaction time data for L1 German group (*n* = 24) on the spillover segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	466.35	33.48	13.93	< .001
Type	-80.64	22.84	-3.53	**.001**
Aspect	-7.37	17.05	-0.43	.67
Proficiency	16.34	32.34	0.51	.62
ClozeTest	-10.98	32.7	-0.34	.74
Type*Aspect	9.46	20.93	0.45	.65
Type*Proficiency	-13.68	21.9	-0.63	.54
Aspect*Proficiency	-1.08	15.77	-0.07	.95
Type*ClozeTest	16.39	22.00	0.75	.46
Aspect*ClozeTest	28.68	15.17	1.89	**.06**
Type*Aspect*Proficiency	9.03	21.77	0.42	.68
Type*Aspect*ClozeTest	-12.08	22.03	-0.55	.58

Formula in R: *Spillover ~ Type*Aspect*scale(Proficiency) + Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

The final segment showed a marginally significant main effect of Type. Considering that the same main effect was found in the disambiguation and spillover segment, apparently, the effect still lingered in the final segment. No other main effects or interactions were found, which also goes for the Type and Aspect interaction. Table 130 lists all the results of the model of the final segment.

Table 130. Output from linear-mixed effects models run on residual reaction time data for L1 German group (n = 24) on the final segment.

	Estimate	SE	t-value	p-value
(Intercept)	525.31	48.06	10.93	< .001
Type	-48.26	25.28	-1.91	**.06**
Aspect	-18.16	25.48	-0.71	.48
Proficiency	24.14	46.22	0.52	.61
ClozeTest	14.80	46.67	0.32	.75
Type*Aspect	37.81	30.17	1.25	.21
Type*Proficiency	8.59	26.03	0.33	.74
Aspect*Proficiency	14.70	24.76	0.59	.55
Type*ClozeTest	9.80	26.13	0.38	.71
Aspect*ClozeTest	7.44	24.09	0.31	.76
Type*Aspect*Proficiency	-8.16	31.72	-0.26	.80
Type*Aspect*ClozeTest	-0.75	31.28	-0.02	.98

Formula in R: *Final ~ Type*Aspect*scale(Proficiency) + Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Figure 53 illustrates the mean RTs per segment for the L1 Croatian group. The same model as the one with L1 German learners was employed in this analysis as well, with Type, Aspect, Proficiency and Cloze test as fixed effects. One of the difference between the L1 German and the L1 Croatian group is that the number of Croatian learners tested in this study was significantly higher, counting 24 German learners and 40 Croatian learners of English. Figure 53 shows longer RTs for the early closure items in the disambiguation and spillover segment. The effect seems to disappear in the final segment. The final segment also shows similar RTs for early and closure conditions per Aspect.

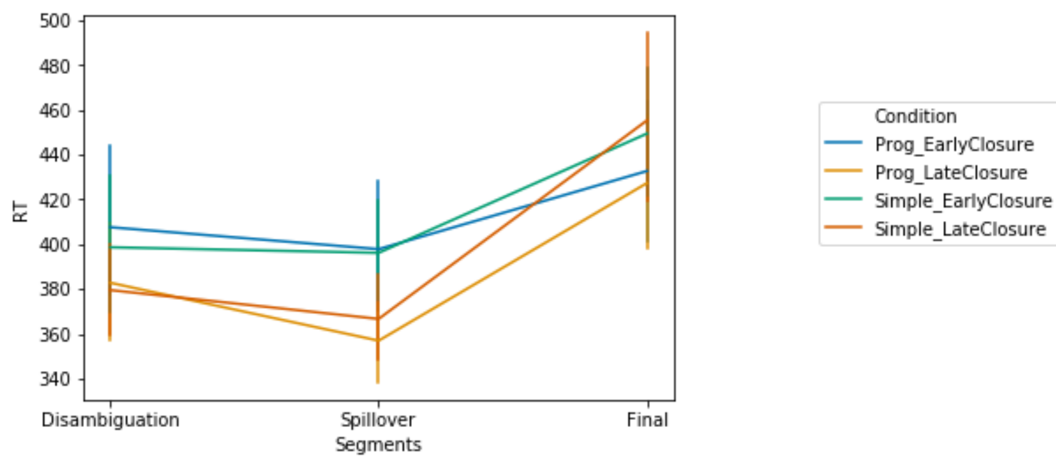

Figure 53. L1 Croatian L2 learners' reading times (RTs) on the three segments during SPR in ms (error bars represent the variability of data) (n = 40).

Table 131 summarizes the main effects and interactions for the disambiguation segment. However, no significant results were found for the group.

Table 131. Output from linear-mixed effects models run on residual reaction time data for L1 Croatian group (n = 40) on the disambiguation segment.

	Estimate	SE	t-value	p-value
(Intercept)	404.12	27.81	14.53	< .001
Type	-24.40	18.95	-1.29	.20
Aspect	-6.05	15.62	-0.39	.70
Proficiency	-4.47	28.96	-0.15	.88
ClozeTest	3.41	28.99	0.12	.91
Type*Aspect	0.55	19.81	0.03	.98
Type*Proficiency	-13.70	19.57	-0.70	.49
Aspect*Proficiency	10.13	16.63	0.61	.54
Type*ClozeTest	-25.81	19.43	-1.33	.19
Aspect*ClozeTest	-10.50	16.92	-0.62	.54
Type*Aspect*Proficiency	3.14	21.45	0.15	.88
Type*Aspect*ClozeTest	19.22	21.89	0.88	.38

Formula in R: *Disambiguation ~ Type*Aspect*scale(Proficiency) + Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

A slightly different picture was found in the spillover segment (Table 132). An effect of Type was recorded, again, supporting that there were delays when reading early closure sentences. A marginally significant effect was found for the Type, Aspect and Proficiency interaction; and a significant interaction between Type, Aspect and Cloze test. These results give some support for differential processing of aspect in English, but in order to find out what exactly the direction of the effect is, the group will be split into a high and low aspect awareness group after the by-group analyses.

Table 132. Output from linear-mixed effects models run on residual reaction time data for L1 Croatian group (*n* = 40) on the spillover segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	395.59	22.42	17.65	< .001
Type	-39.99	16.61	-2.41	**.02**
Aspect	-2.07	13.95	-0.15	.88
Proficiency	-8.77	19.05	-0.46	.65
ClozeTest	-24.50	19.06	-1.29	.21
Type*Aspect	8.53	17.74	0.48	.63
Type*Proficiency	-7.90	14.12	-0.56	.58
Aspect*Proficiency	-4.66	14.11	-0.33	.74
Type*ClozeTest	23.19	13.96	1.66	.10
Aspect*ClozeTest	22.68	14.54	1.56	.12
Type*Aspect*Proficiency	33.08	19.21	1.72	**.09**
Type*Aspect*ClozeTest	-43.03	19.52	-2.21	**.03**

Formula in R: *Spillover ~ Type*Aspect*scale(Proficiency) + Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

On the final segment, no interaction nor main effect were found, which could be seen in Table 133.

Table 133. Output from linear-mixed effects models run on residual reaction time data for L1 Croatian group (n = 40) on the final segment.

	Estimate	SE	*t*-value	*p*-value
(Intercept)	431.93	25.45	16.97	< .001
Type	-7.46	21.95	-0.34	.74
Aspect	18.41	19.12	0.96	.34
Proficiency	-27.17	25.82	-1.05	.30
ClozeTest	-14.20	25.78	-0.55	.59
Type*Aspect	7.19	25.52	0.28	.78
Type*Proficiency	-0.31	21.77	-0.01	.99
Aspect*Proficiency	24.45	19.51	1.25	.21
Type*ClozeTest	2.73	21.58	0.13	.90
Aspect*ClozeTest	4.84	19.74	0.25	.81
Type*Aspect*Proficiency	3.25	27.64	0.12	.91
Type*Aspect*ClozeTest	25.34	28.28	0.90	.37

Formula in R: *Final ~ Type*Aspect*scale(Proficiency) + Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

The L1 Spanish group consisted of 23 learners. Figure 54 presents the mean RTs of Spanish learners of English for each segment per condition. The line plot does not show much variation on the spillover and the final segment, as the lines are mostly overlapping. However, in the disambiguation there seems to be longer RTs for the progressive early closure condition. In the continuation, the results of the mixed model will be presented by segment.

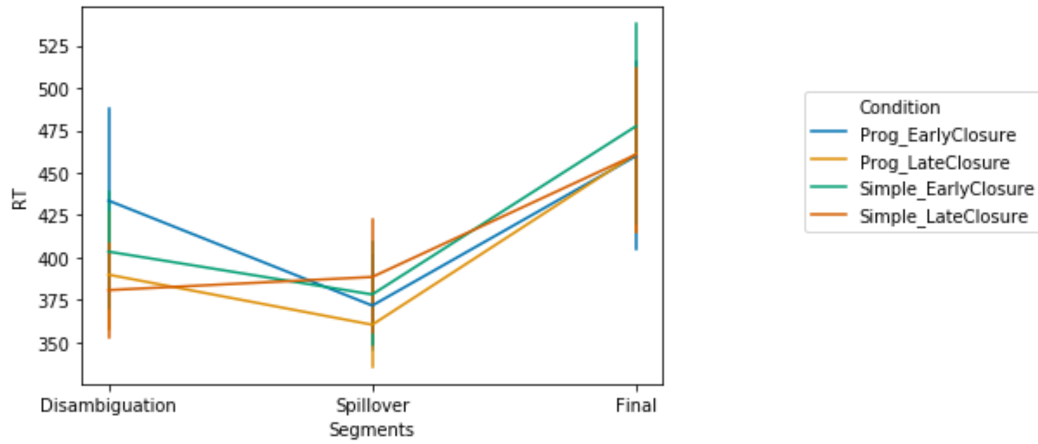

Figure 54. L1 Spanish L2 learners' reading times (RTs) on the three segments during SPR in ms (error bars represent the variability of data) (n = 23).

The same model as with the previous L2 learner groups was employed for detecting if aspect in English is processed incrementally by L2 learners. The disambiguation segment revealed a main effect of Type and a marginally significant main effect of Aspect. The pattern is the same as in all previously discovered main effects of Type, with early closure sentences being more difficult to process than the late closure, regardless of aspect. The effect of Aspect shorter RTs for the simple aspect. No other significant results were found (Table 134).

Table 134. Output from linear-mixed effects models run on residual reaction time data for L1 Spanish group (n = 23) on the disambiguation segment.

	Estimate	SE	t-value	p-value
(Intercept)	435.96	37.32	11.68	.001
Type	-51.13	22.94	-2.23	**.03**
Aspect	-35.31	20.2	-1.75	**.08**
Proficiency	40.12	35.72	1.12	.27
ClozeTest	23.05	35.65	0.65	.52
Type*Aspect	31.64	27.68	1.14	.25
Type*Proficiency	-19.77	22.39	-0.88	.38
Aspect*Proficiency	-7.17	20.34	-0.35	.72
Type*ClozeTest	-19.29	22.24	-0.87	.39
Aspect*ClozeTest	-9.48	20.82	-0.46	.65
Type*Aspect*Proficiency	6.00	28.00	0.21	.83
Type*Aspect*ClozeTest	11.50	28.3	0.41	.68

Formula in R: *Disambiguation ~ Type*Aspect*scale(Proficiency) + Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Yet, the model on the spillover segment does not show significant results for main effects nor interactions. Table 135 summarizes the findings of Spanish learners of English for the spillover segment.

Table 135. Output from linear-mixed effects models run on residual reaction time data for L1 Spanish group (n = 23) on the spillover segment.

	Estimate	SE	t-value	p-value
(Intercept)	371.69	23.24	16.00	.001
Type	-16.30	14.62	-1.12	.27
Aspect	6.70	18.86	0.36	.73
Proficiency	27.72	22.79	1.22	.24
ClozeTest	23.03	22.83	1.01	.32
Type*Aspect	27.57	20.19	1.37	.17
Type*Proficiency	-12.40	14.59	-0.85	.40
Aspect*Proficiency	1.88	18.88	0.10	.92
Type*ClozeTest	-9.57	14.70	-0.65	.52
Aspect*ClozeTest	-10.34	19.09	-0.54	.59
Type*Aspect*Proficiency	3.80	20.44	0.19	.85
Type*Aspect*ClozeTest	-14.48	20.62	-0.70	.48

Formula in R: *Spillover ~ Type*Aspect*scale(Proficiency) + Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

The final segment revealed an interaction of Type and Cloze Test (Table 136). Moreover, a highly significant interaction of Aspect and Cloze Type was detected. This means that Cloze Test affected the processing of Aspect and Type. More information will be given in the following. More importantly, there was an interaction between Type, Aspect and Cloze test. Considering that the interaction between Type and Aspect was found in combination with the effect of Cloze test, the participants will be divided and analyzed based on how they performed in the test.

Table 136. Output from linear-mixed effects models run on residual reaction time data for L1 Spanish group (n = 23) on the final segment.

	Estimate	SE	t-value	p-value
(Intercept)	462.31	48.51	9.53	.001
Type	-7.92	32.61	-0.24	.81
Aspect	23.49	28.95	0.81	.42
Proficiency	55.84	46.35	1.21	.24
ClozeTest	63.05	46.22	1.36	.19
Type*Aspect	-14.54	34.30	-0.42	.67
Type*Proficiency	-36.06	34.17	-1.06	.30
Aspect*Proficiency	-1.28	28.35	-0.05	.96
Type*ClozeTest	-74.58	33.35	-2.24	**.03**
Aspect*ClozeTest	-89.81	28.65	-3.14	**.002**
Type*Aspect*Proficiency	-19.33	34.92	-0.55	.58
Type*Aspect*ClozeTest	127.70	35.14	3.63	**.001**

Formula in R: *Final ~ Type*Aspect*scale(Proficiency) + Type*Aspect*scale(ClozeTest) + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Summary

The by-group analyses revealed effects of Type, i.e. longer RTs for the early closure items, on all segment for the L1 German group. The spillover segment also showed a marginally significant interaction of Aspect and Cloze test. The L1 Croatian group displayed the effect of Type, but only on the spillover segment. The spillover segment also revealed interactions of Type and Aspect, but in the combination with Proficiency and Cloze test. The L1 Spanish group showed a main effect of Type and a marginally significant main effect of Aspect on the disambiguation segment. The main effect of Aspect was shown in longer RTs for the past progressive items. Even though the spillover segment found no significant results, the final segment found three interactions: Type and Cloze Test; Aspect and Cloze Type; and Type, Aspect and Cloze test. Because in the case of L1 Croatian and L1 Spanish learners there were interactions with Cloze test, the following analyses will look at how the cloze test scores affect the results for these two groups.

4.6.5.2.4. By-group analysis: Cloze test split.

Because the findings showed interactions of Type and Aspect with the Cloze Test for the L1 Croatian and the L1 Spanish learners, the following paragraphs will look at these L1 groups individually, however, divided in two groups according to their score on the cloze test. The median split was carried out depending on the groups' median of the cloze test scores. The participants were divided into those who scored below (low aspect awareness) and above (high aspect awareness) the median. Type and Aspect were included in the model as fixed factors, along with the same slopes and intercepts as in the previous analyses.

The L1 Croatian low aspect awareness group revealed no significant results for the disambiguation and the final segment (for more detailed description, see Appendix C). In the spillover, however, the results showed a main effect of Type (β = -62.50, *SE* = 23.23, *t* = -2.69, *p* = **.01**) and a marginally significant interaction of Type and Aspect (β = 44.74, *SE* = 25.92, *t* = 1.73, *p* = **.09**). The effect of Type reflected higher RTs for early closure, and the marginal Type and Aspect interaction revealed longer reading times for early closure only in the past progressive. This is the opposite of what would be expected. The high aspect awareness group showed no significant difference on any of the segments.

The L1 Spanish low aspect awareness group displayed no significant effects on the disambiguation and the spillover segment. In the final segment, there was a main effect of Aspect (β = 67.56, *SE* = 30.24, *t* = 2.23, *p* = **.03**) which reflected longer RTs for simple aspect. In addition, the following interaction was found: Type and Aspect (β = -88.90, *SE* = 40.75, *t* = -2.18, *p* = **.03**). The interaction of Type and Aspect reflected shorter reading times for early closure items than late closure in the past progressive. No differences were visible in the past simple condition. The high aspect awareness group had an effect of Type on the disambiguation segment (β = -87.49, *SE* = 39.47, *t* = -2.22, *p* < **.03**), which was caused by the longer RTs for early closure sentences. No significant results were found in the spillover segment, except for a marginal main effect of Type (β = -112.94, *SE* = 61.99, *t* = -1.82, *p* < **.09**) which reflected longer RTs for the early closure items. The interaction of Type and Aspect was visible on the final segment (β = 128.02, *SE* = 59.33, *t* = 2.16, *p* < **.03**). The interaction revealed higher RTs for early closure sentences in the progressive aspect and no difference between sentence types in the past simple (detailed results in Appendix C). Critically, the interaction of Type and Aspect in the L1 Croatian and L1 Spanish high and low awareness group went in the opposite direction of the effects reported for native English speakers.

4.6.5.3. Overall summary.

None of the groups replicated the study by Roberts and Liszka (2019). The interaction of interest was between Type and Aspect, as the early closure items in the past simple were predicted to be read more slowly than the past progressive items. What is more, the effect was predicted to happen with the L1 Croatian and L1 Spanish group as they grammaticalize aspect in their L1, yet, no such interaction was obtained. The garden-path effect was constant throughout the analyses for all groups: on all segments for the L1 German group, on the spillover segment for the L1 Croatian group and on the disambiguation segment for the L1 Spanish group. Yet, the slowdowns when reading the direct object preceded by the verb in past tense were not detected. Further analysis, such as median split based on the cloze test did not reveal any evidence for crosslinguistic influence in L2 processing of aspect. The L1 Spanish low awareness group shoed longer RTs for early closure compared to late closure items in progressive, and L1 Spanish high awareness group showed longer RTs for early closure compared to late closure items in progressive. Therefore, the asymmetry in reading past simple vs. past continuous early closure sentences similar to Roberts and Liskza (2019) was not detected.

4.7. Discussion

In this study, learners with different L1s were tested (i) on their L2 knowledge of aspect in production and (ii) whether L2 learners use aspectual distinction for inferences about sentence structure in online sentence comprehension. A measure used to test L2 production of aspect was a cloze test and a self-paced reading task was used as the online measure for sentence comprehension. L2 English learners were divided in three groups according to their L1 (i.e., German, Croatian and Spanish). Each L1 has a different realization of aspect and was strategically chosen to disentangle possible crosslinguistic influences in L2 sentence comprehension, summarized in Table 137.

Table 137. Grammatically encoded tense and aspect oppositions across L1s (German, Croatian and Spanish) and L2 (English) in this study

	English	German	Croatian	Spanish
Past/non-past	+	+	+	+
Perfective/imperfective	-	-	+	+
Progressive/simple	+	-	-	+

Based on these differences, the learner groups were tested by using production and comprehension tests to assess learners' use of L2 aspect. In the cloze test, all learners showed knowledge of English aspectual distinctions. Each group's mean score was above chance. Yet, there was a difference in scores, and the results showed that the L1 Croatian group was on average more accurate in its use of L2 English tense.

The first results from the self-paced reading task on L2 sentence comprehension revealed that all learners were led down the garden path with past simple and past progressive items as shown in longer reading times for early closure as opposed to late closure items. The L1 German group showed slowdowns for early closure items on all critical regions: disambiguation, spillover and final. The L1 Spanish group showed slowdowns only on the disambiguation segment, but the effect was not present on segments following that one. Finally, the L1 Croatian group showed slowdowns only on the spillover segment, which disappeared on the final segment.

Yet, there was no asymmetry in RTs for the past simple early closure versus past progressive early closure items. In other words, the slowdowns on the disambiguation segment for past simple items were not significantly different from the slowdowns on the same segment for the past progressive items. The results imply that event conceptualization information on the verb and object was not used during L2 English sentence comprehension, otherwise there would have been an asymmetry in the RTs. Therefore, the study did not find the same results as the studies on L2 learners (Roberts & Liszka, 2016, 2019). Because we did not see difference between groups, the results do not support Roberts and Liszka's (2016, 2019) proposal that the crosslinguistic differences in the sensitivity to aspectual distinctions in English were guided by grammaticalized aspect in the learners' L1. The findings will be discussed based on research on aspect production and comprehension and will discuss crosslinguistic differences (Table 137) in more detail.

When looking at the results, all L1s grammaticalize tense, so tense was not the reason for the lack of the online use of aspect. A prediction based on Roberts and Liszka's study (2019) suggested that the instantiation of aspect in the L1 was the prerequisite, however, neither the L1 Croatian nor the L1 Spanish showed the incremental use of English aspect. This means that the crosslinguistic differences in the realization of aspect on verbs in the L1 were not a leading factor for the lack of interpretation of L2 clause boundedness.

Furthermore, if the instantiation of progressiveness was an important factor in the interpretation of boundedness on the verb and the direct object, Spanish learners of English would have shown incremental processing of L2 aspect. This is because Spanish has a specific grammatical marking on the verb to express progressiveness, similarly to English. Yet, this was not the case. Therefore, none of the predicted factors (i.e., grammatical aspect and grammatical marking of progressive) affected the results. As a consequence, the results did not support previous findings that L1 aspect is a crucial component for L2 aspect use (Flecken, 2011; Roberts & Liszka, 2019).

Liszka (2015) pointed out an important factor in L2 use of aspect, which is task type. In her study, learners were not successful in using the L2 tense information in the 'online' production task, which was a task in a form of eliciting guided spontaneous description of events in a picture or a video. However, target-like use was seen in the written production task, which was a 'fill in the gaps' task. Liszka (2015) explained the results by using the Representational Deficit Hypothesis (Hawkins, 2005; Hawkins & Liszka, 2003) stating that if there are differences between L1 and L2 features, they will be seen in the optionality of the use of the same feature (i.e., selective fossilization). Yet, the findings in this study do not seem to derive from the differences between L1 and L2, as Spanish and English both have grammatical ways of expressing progressiveness, but we do see a knowledge of L2 English aspect offline which was not replicated online.

The approaches to L2 acquisition, such as the Feature Reassembly Hypothesis (Lardiere, 2009) as part of a generative approach and learned attention (Ellis & Sagarra, 2010b) as part of a usage-based approach advocate for crosslinguistic transfer. In this case the FRH would predict that if L1 and L2 have differences in the organization of feature bundles, learners would not act target-like. In this case, Spanish learners did not have to reorganize the feature bundles, yet, they did not use aspectual information on the verb and the object. Learned attention looks at differences between L1 and L2 cues, for example, grammatical means to express aspect vs. lexical means to express aspect. It would mean that if L2 English learners are not used to relying on morphosyntactic information in their L1 when it comes to aspect, they will focus only on lexical aspectual cues in the L2. In this case, only German learners do not have grammaticalized markers for aspect, and should be the only ones to not use L2 information during processing. Yet, all learner groups failed to use grammatical markings on verbs and specific object as aspectual information during L2 sentence comprehension.

Having in mind that Roberts and Liszka (2019) found incremental processing with native English speakers, and my study did not test English monolinguals, I can only hypothesize that there would be a difference between L1 monolinguals in their study (as a control group) and between L2 speakers in my study. Even though there was no asymmetry between the commitment of the verb to a direct object, L2 learners still showed the use of L2 morphosyntactic information as there were all led down a garden path.

4.7.1. Limitations.

The study at hand also suffers from some limitations that might have affected the results. For instance, the number of participants varied across groups. The L1 German and L1 Spanish group had 24 and 23 participants, respectively, while the L1 Croatian group counted 40 participants. The age differences showed that the L1 Croatian group was on average younger than the L1 German and L1 Spanish group. The age of acquisition also differed, showing that L1 Croatian and L1 Spanish speakers started learning the language earlier than the L1 German group, but this difference was not realized in the number of years learning L2 English. Another important factor to mention is proficiency, which was seen in lower scores for the L1 Spanish group in the LexTALE. This might have affected the lack of L2 aspectual use of Spanish learners in the self-paced reading task. The proficiency moderately corelated with the cloze test, where the L1 German and L1 Spanish group showed lower scores than the L1 Croatian group. Yet, it is important to mention that there were no differences visible in the CFT on L2 vocabulary between groups indicating the same level of proficiency in the L2 between groups.

4.7.2. Conclusion.

To conclude, the current study tested (i) whether information about the boundedness of an event encoded in the grammatical aspect of verbs and the cardinality of NPs affect L2 processing, and (ii) if there are crosslinguistic differences between learners with different aspect encoding in the L1. The measure for L2 production (i.e., the cloze task) showed that all groups were proficient in their use of L2 aspect, while the SPR task showed that L2 learners use morphosyntactic information by showing slowdowns in object-subject ambiguities. Yet, what the learners did not show is the use of aspect seen as the information of boundedness on the verb and a noun phrase. The results do not confirm the findings of the previous studies (Flecken, 2011; Roberts & Liszka, 2016, 2019) which state that the presence of grammaticalized aspect in the L1 is a prerequisite for the incremental use of aspect in the L2. Crosslinguistic influence, as predicted by the FRH and learned attention, was not detected in sentence comprehension since there were no differences between L1 groups.

In short, the current study gave contradicting results compared to previous studies on aspect (Flecken, 2011; Roberts & Liszka, 2019ab), but it also calls for more research on the same topic. It showed that L2 learners can use morphosyntactic information incrementally, but that they did not use aspectual information about boundedness seen on the verb and the noun phrase following it. In other verbs, the learners did not show a stronger commitment to a direct object when a verb signaled boundedness. Moreover, there was no crosslinguistic influence on the findings, as all L1 groups showed similar results during sentence comprehension. The results will be discussed in more detail in the context of L2 research on acquisition in Chapter 5.

5. General Discussion

In this thesis I tested whether L2 learners of English with a variety of L1 backgrounds (i.e., Croatian, Spanish and German) activate their L1 in L2 sentence comprehension. In particular, three different types of lexical-grammatical information were tested in online and offline tasks in order to explore the scope of crosslinguistic influence in L2 sentence processing. Specifically, the research focused on the crosslinguistic influence in gender agreement between the noun and anaphoric pronoun, coreference violations of tense between a temporal adverbial and the verb, and the interpretation of boundedness in object-subject temporarily ambiguous sentences. The findings of the mentioned studies show that some crosslinguistic influence is present in L2 sentence comprehension, but it is also asymmetric across studies and L1s and it depends on different factors.

In this chapter, I will present a summary of three studies, i.e. the experiments used and the findings. I will discuss the results with respect to different approaches to L2 acquisition and L2 processing. I argue that crosslinguistic influence in sentence processing is selective and is influenced by task effects such as the language-mixing context and linguistic effects rooted in the L1.

5.1. Summary of All Studies

In this section, the results of the four major experiments on three different topics are summarized, namely, on grammatical gender, present perfect tense and grammatical aspect. Each experiment consisted of multiple tasks, focusing on the production and comprehension of the lexical-grammatical information and on the crosslinguistic influence in L2 processing. Three different L1 groups were tested, namely, L1 Croatian, L1 Spanish and L1 German intermediate to advanced learners of English. Table 138 summarizes the studies according to the three L1 groups.

Table 138. Tasks and results for Study 1, Study 2 and Study 3 ('+' denotes that L1 co-activation is present, '–' denotes that L1 co-activation is not present)

	Exp	Type of task	Phenomenon	Croatian	Spanish	German
Grammatical gender	1	Online LDT	Cognate facilitation effect	NA	NA	–
	1	Online PNT	Cognate facilitation effect	NA	NA	+
	1	Online Visual World	Cognate facilitation & gender congruency	NA	NA	–
	2	Online LDT	Cognate facilitation effect	–	+	+
	2	Online PNT	Cognate facilitation effect	–	+	+
	2	Online Visual World	CLI in Gender agreement	+	–	+
Present perfect tense	3	Offline Cloze test	Knowledge of English tenses	–	–	–
	3	Offline AJT	Coreference agreement violations	–	–	–
	3	Online SPR	Coreference agreement violations	–	–	–
Grammatical aspect	4	Offline Cloze test	Knowledge of English aspect	–	–	–
	4	Online SPR	Object-subject temporary ambiguities	–	–	–

Experiment 1 and Experiment 2, both part of Study 1, were concerned with the activation of L1 grammatical gender during gender agreement between a noun phrase and anaphora in L2 sentence comprehension. Experiment 1 was a study that tested L1 German L2 English learners in a visual world eye-tracking task that used a L2 English context only. In (1) the spoken discourse that introduces an inanimate (*the lamp*) and an animate (*the grandma*) entity in the first sentence is shown. Crosslinguistic influence from L1 German was expected in the second sentence when the pronoun *she* is introduced, since L1 German learners of English may consider the grandma ('die Oma$_{\text{GER}}$') and the lamp ('die Lampe$_{\text{GER}}$') as potential referents to the pronoun *she*. Therefore, increased looks towards the lamp were expected when the pronoun is *she* rather than *he* (i.e., 'The lamp$_{\text{FEM}}$ will be turned on by the grandpa$_{\text{MASC}}$. *He* is…').

(1) The lamp$_{\text{FEM}}$ will be turned on by the grandma$_{\text{FEM}}$.
She$_{\text{FEM}}$ is at the other end of the room.
The grandma should walk to the lamp to turn it on.

The study found a cognate facilitation effect at the lexical level in comprehension – the lexical decision task, and in production – the picture naming task; yet no L1 activation of grammatical gender. Due to the lack of L1 gender activation in the online visual world task, Experiment 2 was constructed in order to heighten the activation of the L1 through a language-mixing context. By introducing the top-down activation of the L1, I could test which level of activation is needed for L1 to transfer and which factors influence L1 transfer. In this way, I could rule out possible reasons for not finding crosslinguistic influence. Therefore, Experiment 2 used a language-mixing context in the visual world task where the first sentence was always in the learner's L1 (2).

(2) a. Lampa$_{\text{FEM}}$ će biti upaljena od strane starice. (Croatian)
Lamp will be turned on from side grandma.
b. La lampara$_{\text{FEM}}$ será encendida por la abuela. (Spanish)
The lamp will be turned on from the grandma.
c. Die Lampe$_{\text{FEM}}$ wird von der Oma angeschaltet. (German)
The lamp will from the grandma turned on.

The LDT and the PNT were the same as in Experiment 1, but the items were adapted to the L1s. A cognate facilitation effect was found in the LDT and PNT for the L1 Spanish and L1 German group, but not for the L1 Croatian group. The online visual world task found activation of L1 gender for the L1 German group and marginally for the L1 Croatian group, however, not for the L1 Spanish group. This means that the L1 Spanish group only looked at the animate object (i.e., the grandma) when hearing the pronoun *she*.

Study 2 used coreference agreement violations between the temporal adverbial and the verb in present perfect or past simple tense in order to test if the L1 affects the learners' sensitivity in the L2 (3). In this case, the verb was either in past simple or present perfect (3) and the temporal adverbial at the beginning of the sentence either matched with the verb (3a) or mismatched (3b).

(3) a. Present perfect, Match
Since last month, Sarah has felt unhappy at work. She even thought about leaving.
b. Present perfect, Mismatch
Last month, Sarah has felt unhappy at work. She even thought about leaving.

By using tense mismatches, the differences in the grammaticalization of aspect (Roberts & Liszka, 2013) and tense in the L1 were investigated. All L1s in Study 2 have different realization of tense and aspect, and considering that some aspect/tense realizations did not overlap with L2 English, crosslinguistic differences were expected to surface in those cases for L2 processing. All L1 groups showed that they had target-like knowledge of L2 English tense in a cloze test, yet they all showed a lack of sensitivity to tense mismatches in the production and comprehension of tense mismatches. Thus, no differences between the groups were observed, even though the L1s all had different realization of tense and aspect compared to the L2.

Finally, Study 3 used object-subject ambiguities to test whether grammatical aspect (e.g., progressive) can be used in order to infer clause boundaries. Simple tense in the past conveys a bounded event that was finished in the past, and usually it is followed by a specific subject that provides an endpoint (Frazier et al., 2006). Progressive, on the other hand, denotes an ongoing event and for this reason does not require an endpoint. English native speakers were shown to be led down the garden path significantly more when the verb is in past simple than in the past progressive (4b).

(4) a. Past progressive, Late Closure
Even when Joe was cleaning the small kitchen it smelled like old rubbish.
b. Past progressive, Early Closure (Garden path)
Even when Joe was cleaning the small kitchen smelled like old rubbish.

Because the L1s used in this study differ in the realization of aspect, the L1 groups were expected to perform differently. A cloze test tested the learners' knowledge of L2 aspect, which was advanced. Yet, a self-paced reading task revealed that L2 English learners did not use progressive aspect for detecting clause boundaries in L2 sentence comprehension. This means that none of the groups was led down the garden path more when the verb was in past simple. They did, however, show the use of L2 structural information because they were led down the garden-path in early closure conditions.

In summary, the influence of the L1 during L2 sentence comprehension was found to be selective. In other words, it was present only in Study 1 on grammatical gender, but was absent in Study 2 and Study 3 on grammatical information. Therefore, not all experiments showed crosslinguistic influence, and when present, it was not seen across all L1 groups. Crosslinguistic influence was detected in Study 1, showing the co-activation of L1 gender along with the lexical co-activation (i.e., in the case of cognates), but only in the case of L1 German and L1 Croatian learners of English and in a language-mixing context.

5.2. Contribution to Second Language Acquisition

In this section, the results of the dissertation will be discussed in the context of theories arguing against (Clahsen & Felser, 2006) and for (Ellis & Sagarra, 2010b; Lardiere, 2009) crosslinguistic influence in the L2. By investigating crosslinguistic influence, the results of the current study can be directly compared to the predictions of theories on L2 processing and L2 acquisition. The Shallow Structure Hypothesis (Clahsen & Felser, 2006) will be used as a hypothesis that argues against crosslinguistic influence in the context of L2 processing. In support of crosslinguistic influence, theories from a generative and usage-based approach will be employed. The Feature Reassembly Hypothesis (Lardiere, 2009) conceptualizes crosslinguistic influence as differences in L1-L2 feature representation from a generative perspective. Learned attention (Ellis & Sagarra, 2010b, 2010a) addresses crosslinguistic influence from the perspective of usage-based acquisition of the L2. Table 139 summarizes the results of the experiments based on the activation of the L1.

Table 139. The presence of crosslinguistic influence in all studies for L2 English learners with different L1s

	Croatian	Spanish	German
Grammatical gender	+	–	+
Present Perfect Tense	–	–	–
Grammatical Aspect	–	–	–

The SSH (Clahsen & Felser, 2006) does not posit crosslinguistic influence to be a main reason for differences between L1-L2 processing, but it focuses on the nontarget-like processing of L2 learners, especially regarding the use of grammatical information in the L2. According to the SSH, late L2 learners have difficulty in employing grammatical structure in real time that is needed in order to successfully interpret the incoming material. In the case of my thesis, I am using learners with three different L1s. However, according to the SSH, the learners are not predicted to differ in L2 sentence comprehension as the L1 is not the reason for nontarget-like in L2 processing. Since my thesis is looking at gender agreement, coreference agreement violations and object-subject ambiguities, which are all linguistic systems that go beyond the lexical level, L2 learners are predicted to show nonnative-like L2 processing. Yet, the nontarget-like processing is argued not to stem from their L1. This means that all L2 learners are supposed to perform similarly, irrespective of their L1, based on previous research (Papadopoulou & Clahsen, 2003). When we look at the results of the experiments on gender, tense and aspect, there were no significant differences in L2 processing of coreference agreement violations and object-subject ambiguities between the three L1 groups. This could be interpreted as evidence supporting the SSH, yet, in object-subject ambiguities, learners were still led down the garden path, even though they did not use the information about the boundedness of an event. Therefore, we can see that learners do use structural information in L2 sentence comprehension of temporarily ambiguous sentences, but not the information about event structure. As for the experiment on grammatical gender, we can see that L1 gender activation was present only for the L1 German and L1 Croatian group. One could argue that gender is a lexical information, as it is usually represented as a part of a mental lexicon; yet, in this case we are talking about the implementation of gender in gender agreement, which goes beyond the lexical level. Moreover, it could also be argued that the L1 Spanish group did not show L1 gender co-activation, which means that they showed native-like processing of L2 gender agreement. All in all, the SSH is not able to explain the findings from all experiments.

As part of a generative approach, the FRH (Lardiere, 2009) looks at the difficulties in L2 acquisition of morphosyntax as a difference in the configuration of features between the learner's L1 and L2. Learners go through the mapping stage where the L1 features are mapped to their closest equivalents in the L2, and the feature bundles are reassembled according to the configuration in the L2 in the reassembly stage, where some features need to be not only reassembled but also added or deleted, if needed. This, however, applies only to those instances where L1 and L2 feature bundles differ. Yet, the learner does not have to go through all the stages if the L1 and L2 are similar. Even though it is still not clear how exactly the reassembly of the features plays out in detail for all types of linguistic information, the FRH offers a plausible explanation for the difference between L1 groups in the case of Experiment 2 on grammatical gender.

All three groups in Study 1 were equipped with grammatical gender, a feature that is not present in English. In the first (mapping) stage, the gender for inanimate nouns in the L1 is mapped to the gender of animate nouns in the L2. Now that the closest feature equivalents were detected, the reassembly stage involves the fusion of grammatical gender for inanimate nouns to neuter in L2 English. Because Spanish does not have neuter grammatical gender, there are fewer steps in the reassembly stage, i.e. fewer features to be reassembled. This might have affected the results, as the L1 Spanish group has fewer steps than the other two groups in the feature reassembly and, therefore, has less L1 influence when processing L2 sentences. Since differences between German-English and Croatian-English are greater, the L1 gender influence in L2 processing is more prevalent.

The FRH also advocates for crosslinguistic influence in the case of present perfect tense, as German and Croatian do not have a tense which is exclusive to a perfective meaning. Spanish, on the other hand, has an equivalent tense in form and meaning to the English present perfect tense, and L1 Spanish learners are, therefore, expected to show less crosslinguistic influence as they do not have to go through the reassembly stage. In the first stage, L1 German and L1 Croatian learners are expected to map the past compound tense (i.e., *Perfekt*) to the either past simple tense or present perfect. For the L1 German group, this would mean that when presented with coreference agreement violations, they should only be sensitive to past simple mismatches, as *Präteritum* does not allow the use of a temporal adverbial like ‘since’. As for the L1 Croatian group, they should not be sensitive to mismatches for both tenses as L1 Croatian has only one tense expressing past events (*Perfekt*). Therefore, in the reassembly stage, both the L1 German and L1 Croatian group have to separate two meaning that *Perfekt* encompasses in order to successfully reassemble the features according to L2 English. Yet, all L1 groups show insensitivity to mismatches, regardless of the mode of the task, i.e. production or comprehension.

In the case of grammatical aspect, the FRH makes very similar predictions. Spanish grammatically encodes the progressive vs. nonprogressive distinction, while Croatian grammaticalizes the imperfective vs. perfective distinction. German does not use grammatical means to express aspectual distinctions. The task in the reassembly stage is for L1 German learners to acquire a completely new feature in the L2 (i.e., progressiveness) and for L1 Croatian learners to separate the uses of imperfectivity to progressive and habitual meanings, in order to match the feature configuration in English. Based on the differences between the L1 and the L2, the L1 German group is expected to show the highest crosslinguistic influence, the L1 Croatian group might show crosslinguistic influence, because the learners have to go through the reassembly stage, but not as strongly as the L1 German group. The L1 Spanish group is expected to use aspectual information on the verb and the object as the marker of boundedness. Again, all three groups performed the same and did not use aspectual information. Therefore, the FRH cannot completely explain the results of all three studies on L2 sentence comprehension. The hypothesis might be a good explanation for the L1 activation of grammatical gender, but it cannot be applied to the experiments on present perfect tense and grammatical aspect.

Usage-based approaches, like the focus on learned attention by Ellis and Sagarra (2010b, 2010a), advocate for L1 experience influencing the L2 acquisition. In other words, because L1 cues through experience have become more reliable for a learner, they might affect the acquisition of L2 cues. Therefore, if there are differences between L1 and L2 cues, crosslinguistic influence is expected to take place. Because learned attention has mostly been tested with temporal reference on the verb and adverb, it is not clear how the ‘blocking’ process functions with different types of information and also what happens if the L2 lacks the feature that is present in the L1. Study 1 covers grammatical gender, where all L1 groups are used to relying on morphological cues such as gender agreement on the determiner, adjective or pronoun. Yet, these cues are irrelevant for L2 English as grammatical gender is not present. In this case, gender agreement with the pronoun was tested, and all L1s have biological gender and use pronouns to refer to animate entities. I argue that the experience with L1 cues in this case is irrelevant because L2 English does not instantiate grammatical gender, and for this reason the L1 cues will not compete with L2 cues. Yet, the results showed differences between groups for L1 gender co-activation.

In the case of present perfect tense, L1 Croatian learners resort to lexical cues in their L1, as the language has only one past tense that encompasses both meanings. This would mean that for L1 Croatian learners, the focus would be only on the L2 lexical cues because they are more reliable than the L2 morphological cues on the verb. In the case of past simple, the learners would be sensitive to both lexical and morphological cues, which would be shown in past simple mismatches. Quite similarly, L1 German learners also rely mostly on lexical cues in their L1 for present perfect, but are used to relying on both lexical and morphological cues for past simple items. The L1 Spanish group relies on both cues in their L1 when it comes to present perfect tense, and was, therefore, expected to show sensitivity to temporal mismatches in both past simple and present perfect. However, all groups showed insensitivity to tense mismatches online and offline for present perfect tense.

As for grammatical aspect, only the L1 German group was expected to show signs of crosslinguistic influence as the learners use lexical cues in their L1 to express aspect of an event. Not only did the L1 German group not use L2 aspectual cues for L2 boundedness of an event, but the same pattern was seen in the L1 Croatian and L1 Spanish group. Thus, similarly to the SSH and the FRH, learned attention cannot account for the findings of all experiments in this dissertation.

This section has covered approaches to L2 processing and acquisition that argue for and against crosslinguistic influence. As a well-known hypothesis in L2 sentence processing, the SSH does not focus on crosslinguistic influence as a leading cause for L1/L2 differences. Moreover, L2 learners with different L1s are expected to show no differences in processing from one another and are expected to show the underuse of grammatical information in the L2. The results do not show the pattern predicted by the SSH and they argue for the incremental use of grammatical information during L2 processing. The FRH supports the presence of crosslinguistic influence in L2 acquisition, yet, the FRH cannot account for all the results found in my thesis. It provides a solid support for the activation of L1 grammatical gender, but it cannot account for the lack of crosslinguistic influence in the other two experiments. As a part of the usage-based approach to L2 acquisition, learned attention also advocated for crosslinguistic influence, but it focuses on L2 variability as caused by the difference in L1 and L2 cues. Yet, the predictions of learned attention do not support the findings in all three of my experiments.

5.3. Crosslinguistic Influence and L2 Processing

Research on crosslinguistic influence has been more systematic at the lexical level than at the syntactic/grammatical level. Studies on the bilingual mental lexical have given evidence for non-selective activation of words in bilinguals and trilinguals (Dijkstra & Van Heuven, 2002; Dijkstra et al., 1998; Lemhöfer & Dijkstra, 2004; Van Heuven et al., 1998). Cognates were mostly used for these purposes and many studies showed that bilinguals recognize cognates faster and more accurately than noncognates (Duyck, Van Assche, Drieghe, & Hartsuiker, 2007; Lemhöfer & Dijkstra, 2004; Schwartz & Kroll, 2006; Van Hell & Dijkstra, 2002). The cognate facilitation effect was observed even in a sentence context (Libben & Titone, 2009; Schwartz & Kroll, 2006; Titone et al., 2011; Van Assche et al., 2009). The activation of L1 grammatical gender was recorded in word recognition, word production and in a sentence context during gender agreement (Barto-Sisamout et al., 2009; Bordag & Pechmann, 2007; Conklin et al., 2007; Cook, 2018; Ganushchak et al., 2011; Lemhöfer et al., 2008; Renner, 2014; Scheutz & Eberhard, 2004; Vigliocco et al., 2005). Some studies on L2 sentence processing also found L1 activation, but for lexical-thematic information, such as verb subcategorization properties (Frenck-Mestre & Pynte, 1997; Juffs, 2004). Yet, there is less evidence for crosslinguistic influence when it comes to the activation of L1 grammar. For instance, in research on attachment preferences (i.e., grammatical knowledge of the association of the relative clause with the first or second NP that is introduced), some studies found crosslinguistic influence (Dussias, 2003), other studies found a difference attachment preference use online and offline (Miyao & Omaki, 2002) and some studies found no attachment preference (Felser et al., 2003; Marinis et al., 2005; Papadopoulou & Clahsen, 2003).

Sometimes crosslinguistic influence appeared under specific circumstances. For example, Jacob (2009) found the influence of L1 German in the processing of reduced relative clauses in L2 English, but only in a code-switching (i.e., language-mixing) environment. Jacob (2009) accounted for the results by arguing for a constraint-based account which lists certain constraints that decide if crosslinguistic influence will take place. Those constraints for crosslinguistic influence in L2 syntactic processing are the following: the language of the sentence, the language context, the frequency with which a structure has been encountered before, and the complexity of the structure. According to his account, all structures (i.e., L1 and L2) compete for activation. If a sentence is in the L2, then L2 structures will get the highest amount of activation. Yet, if other constrains match the L1 structure more closely, then crosslinguistic influence is possible. A similar result was found in Hopp's (2017) study on reduced relative clauses, where the experiment in a language-mixing context showed a greater L1 influence.

Therefore, Jacob's (2009) account for crosslinguistic influence in L2 sentence comprehension might be able to explain inconsistency in the L1 co-activation of grammatical gender, grammatical aspect and present perfect tense in this study. For example, the only experiment that showed that crosslinguistic influence is present was the eye-tracking study in Study 1 on the activation of L1 gender during gender agreement. The other two self-paced reading experiments (Study 2 and 3), which were purely in the L2, did not show any difference between learner groups with different L1s.

Table 140. The possibility of L1 activation according to Jacob's (2009) constraints for crosslinguistic influence

	Study 1 grammatical gender	Study 2 present perfect tense	Study 3 grammatical aspect
Language	–	–	–
Frequency	–	–	–
Complexity	+	+/–	+/–
Context	+	–	–

If you compare the constraints between the languages (Table 140), all three studies introduced a linguistic phenomenon that was included in a sentence that is in the L2. The second constraint was the frequency, which was high for present perfect tense and progressive aspect in the L2. In the case of grammatical gender, since it is not present in the L2, the L1 vs. L2 frequency cannot be compared. Yet, Study 1 introduces gender agreement of the biological gender between the animate object and the pronoun, which is highly frequent in L2 English. Having this in mind, I would interpret that the frequency of gender agreement in the L2 is high. When it comes to complexity, all three linguistic properties have very clear rules as to when they should be used and what they represent. L2 gender in English is less complex than in L1s because it only refers to biological gender. However, in all L1s of Study 1 gender becomes more complex considering that there is an addition of grammatical gender used for inanimate nouns. In the case of present perfect tense, I would argue that it is more complex in English than in L1 German and L1 Croatian as it has a specific meaning of a past event with current relevance that excludes the preterit meaning. This means that learners of English have to learn two past tenses instead of a tense with preterit meaning, and would prefer the L1 structure during L2 sentence processing. Looking at progressive vs simple aspect, the complexity of the English aspectual system is higher than the L1 German system that lacks grammatical means of expressing aspect. Yet, the division of grammatical aspect is more complex in the case of L1 Spanish and L1 Croatian, so this is where it is expected for the L2 to have a higher influence. The studies only differ in the language context of the experiments, which is purely in the L2 for Study 2 and 3, and a language-mixing context for Study 1. Following the logic of the account, the language context in Study 1 might have additionally heightened the L1 structure (i.e., grammatical gender) so that it got recruited in the process. Yet, in the experiments on grammatical aspect and present perfect tense, the language context was only in the L2, and even though both of the structures are frequent and less complex in the L2 English, and the language of the sentence was in the L2 English, the L1 was not recruited in the process. Thus, one of the potential factors for the lack of crosslinguistic influence could be a context effect (i.e. a language mixing context) and the complexity of the L1.

Yet, the study on the recruitment of grammatical gender found that only L1 German and L1 Croatian learners of Germans showed the activation of L1 grammatical gender. Therefore, Jacob's (2009) constraint-based account could not account for the asymmetry of crosslinguistic influence in this study. One possible reason might be that L2 proficiency was a factor in studies like on relative-clause attachment preferences (Frenck-Mestre, 2002) and on case and number-marking (Hopp, 2006, 2010). However, crosslinguistic influence was usually visible with low-proficiency L2 learners, but in the current study the L1 Spanish group had a significantly lower proficiency in L2 English when compared to the other L1 groups.

There might be a linguistic factor that guides the presence of crosslinguistic influence, such as properties of the specific languages involved. For example, Study 1 discusses the asymmetry in the number of gender values between L1 and L2, but that there might be something specific to the neuter value that facilitates or blocks L1 activation. Klassen (2016a) argues for the *asymmetric gender representation hypothesis* which claims that the neuter node is stored separately from masculine and feminine nodes, which would be supported by the findings on grammatical gender in Study 1. Moreover, Study 1 also introduces lexical co-activation by using cognates which might have aided the presence crosslinguistic influence.

In summary, the crosslinguistic influence has been detected more so at the lexical level than at the syntactic level in L2 processing. Studies on L2 processing show evidence for crosslinguistic influence (Frenck-Mestre & Pynte, 1997; Juffs, 2004) and the lack of crosslinguistic influence (Felser et al., 2003; Marinis et al., 2005; Papadopoulou & Clahsen, 2003). Task effects, such as the language-mixing context, have been reported to affect the selective nature of crosslinguistic influence in some of the studies (Hopp, 2017; Jacob, 2009). Additionally, with a higher lexical overlap (e.g., in the case of cognates), L1s are most frequently recruited in real-time processing of the L2, as seen in Study 1. Yet, even the account proposed by Jacob (2009) on the selectivity of the crosslinguistic influence does not completely explain the asymmetry of crosslinguistic influence in Experiment 2 on the co-activation of L1 grammatical gender during gender agreement. L2 proficiency is most probably not a factor for the difference in the results of the L1 groups, as the lower proficiency of the L2 usually entails the higher chances of crosslinguistic influence happening (Frenck-Mestre, 2002; Hopp, 2006, 2010), not the reverse. The explanation for the lack of crosslinguistic influence might also be linguistic in nature, as seen in Study 1 (Klassen, 2016a), yet, more research with different L1 learner population might be needed in order to find out what the factors might be.

5.4. Limitations and Implications for Future Research

Even though special attention has been paid to construct the experiments, the current study also includes certain limitations that could be addressed in future research. In this way potential factors affecting crosslinguistic influence in L2 processing can either be ruled out or they could be given additional support, depending on the evidence.

Study 1, in particular, addresses the possibility of sample selection and item matching having an effect on current findings. In Experiment 2, Study 1, the L1 German and L1 Spanish group had fewer critical items than the L1 Croatian group. Yet, the L1 German and L1 Spanish group did not pattern differently from the L1 Croatian group, which would exclude item number as a potential factor. As for the choice of items, the norm for reaction tasks like the LDT and the PNT is the matching of items on frequency, length and neighborhood size. This is done in order to eliminate the confounding effects of those factors, as they were shown to affect L1 word selection. In the case of the L1 Croatian group, not all items could be matched according to the criteria. Specifically, cognates and noncognates in English could not be matched on frequency, length and neighborhood size. The LDT and the PNT did not show evidence for the nonselectivity of languages in the case of L1 Croatian learners. In order to see if the mismatches affected the results in the experiments, a subset of matched items was selected, but the L1 activation was still not present. This could potentially mean that the L1 Croatian group did not activate their L1 at the word level, however, there might be a possibility that the number of matched items (i.e., 9 pairs) was just too small to detect L1 effects.

The proficiency might be another factor that affected the results. In Study 1 we can see that the L1 German and L1 Croatian group patterned together, which could be explained as an effect of proficiency. L1 Spanish learners showed a significantly lower proficiency that the other two groups, which might have affected the results. Yet, studies that have found proficiency effects usually facilitate native-like processing (Dussias et al., 2013; Hopp, 2006), however, this was not the case in this study. Study 2 and Study 3 showed no differences between L1 groups, so proficiency is unlikely to account for L1 activation. Thus, I conclude that the present study did not find strong evidence of proficiency effects.

One of the limitations in this study could potentially be the choice of methodology. Even though both self-paced reading and eye-tracking test L2 sentence comprehension, eye-tracking could potentially give more information about the stages of L2 processing than self-paced reading. With eye-tracking we can measure early and late stages of processing, which might be more suitable in order to be able to compare both measures across all studies. This means that in the self-paced reading task there is no possibility to go back and re-read the segment that has caused problems in sentence comprehension, which is possible in eye-tracking measures. That does not mean that crosslinguistic influence is not possible to detect by self-paced reading, but it could limit the accuracy of evidence. Yet, studies so far that have been tested with both methods have first found evidence in the self-paced reading task which was later replicated in the eye-tracking task (Mitchell, 2004).

To summarize, even though the methodology might not be the issue in the current study as previous studies have shown supporting evidence (Conklin et al., 2007; Roberts & Liszka, 2013, 2019), future research should explore limits of current methods for L2 sentence comprehension in more detail. For that, there should be more eye-tracking studies that replicate self-paced reading studies, in order to get to a consensus of what the most appropriate measure is. Moreover, even though there is a significant difference in L2 proficiency between L1 learner groups, the lack of L1 co-activation is usually affected by a higher L2 proficiency, and not by a lower proficiency (as is the case with L1 Spanish learners). I also argue that the choice and matching of items might have affected the results, as the LDT and PNT tasks did not show evidence for nonselectivity in the case of L1 Croatian learners.

5.5. Conclusion

The current study looked at crosslinguistic influence during L2 sentence comprehension regarding gender agreement, coreference agreement violations and object-subject ambiguities. Aside from looking at different lexical-grammatical phenomena, it also explored how differences between the L1 and the L2 might affect the activation of the L1 by testing learners with different L1s (i.e., German, Croatian and Spanish). The results showed that crosslinguistic influence is present in L2 processing at a lexical level and at a grammatical level with a support of lexical co-activation. In the study on grammatical gender, the nonselectivity of languages was confirmed in the LDT on word recognition and the PNT on word production, showing shorter reaction times for cognates. The lack of crosslinguistic influence for the L1 Croatian group might be explained by the choice of items that were not matched on lexical information, i.e. length, frequency and neighborhood size. In the eye-tracking task gender was activated when there was lexical overlap (with cognates), but only in the case of L1 German and L1 Croatian learners. In Study 2 on present perfect tense and Study 3 on grammatical aspect, crosslinguistic influence was not detected. The results illustrate the selectivity of crosslinguistic influence that might be affected by factors like proficiency, language context, type of information and linguistic differences between languages.

I argue that proficiency did not influence the current results, as the L1 group that did not show L1 co-activation had a significantly lower level of L2 proficiency than other L1 groups. If L2 proficiency was the factor in L2 sentence comprehension, then the results would show the highest L1 activation in the case of lower-proficiency learners. Study 1 lends itself as a fertile ground for exploring possible L1 effects, seen in differences between the realization of grammatical gender in the L1. Crosslinguistic influence was detected only with languages with a tripartite gender system. Yet, there is evidence from previous studies that, even with Romance languages, the recruitment of L1 gender is possible, although not consistently. Instead of looking at the asymmetry of L1 grammatical gender, the nature of gender values might also be the cause for L1 blocking. In particular, it would be interesting to see if other languages with two gender values (i.e., masculine and feminine) that are not a part of the Romance language family would show the activation of L1 gender. In this way, future research would test which of the following factors might have the highest influence on L1 activation: the asymmetry of gender values, language family or a special status of the neuter value.

The current experiments confirm many previous studies showing the lack of crosslinguistic influence at the grammatical level, but a constant L1 activation at the word level. This was illustrated with grammatical gender, which was activated in gender agreement only with cognates, and with the lack of evidence in object-subject ambiguities and coreference agreement violations. Study 2 on tense clearly shows that even though some languages are equipped with present perfect and past simple tense, this did not affect the L2 learners' (in)sensitivity to agreement violations between the temporal adverbial and verb following it. The same pattern was found online and offline. Study 3 on grammatical aspect showed that even though some L1s (i.e., Spanish) have a progressive distinction, it was not recruited in the self-paced reading task. Offline, however, all learners showed a native-like proficiency of the progressive aspect.

Regarding the language context mentioned by Jacob (2009), it is interesting that crosslinguistic evidence was only found in Study 1, and only in Experiment 2 where the language-mixing context was introduced. This piece of information is an important insight for the field which investigates crosslinguistic influence at the sentence level, which means that L1 activation does happen, but only when it is aided by additional L1 information. Further research should investigate if the language context influences all levels of linguistic information and if this is exclusive only to spoken L2 sentence comprehension, or extend also to written L2 sentence comprehension.

Additionally, the results were discussed in broader terms, by addressing theories that support crosslinguistic influence and those who argue against it. Even though the SSH does not regard the L1 as the major factor in L2 processing, the results from Study 1 (Experiment 2) confirm that L2 learners can use grammatical information during L2 sentence comprehension. Yet, SLA approaches (i.e., generative and usage-based) that argue for crosslinguistic influence could not explain the selectivity of the crosslinguistic influence. Thus, the current thesis contributes to the area of L2 acquisition and L2 processing by showing that L1 gets activated at the lexical level (i.e., via cognates), supporting the nonselectivity of languages and the BIA+ model (Dijkstra & Van Heuven, 2002). Crosslinguistic influence is also detected at the sentence level with additional lexical activation, yet, it is possibly also affected by the language context and linguistic factors (L1-L2 differences). Future research is needed in order to find out if crosslinguistic influence happens at all levels of language, and which factors out of the following were responsible for the current findings, i.e. the language-mixing context, additional lexical co-activation and/or L1-L2 differences.

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Appendices

Appendix A

Appendix A: I – Lexical Decision Tasks

List of items used in the Experiment 1 with L1 German

Cognates: banana, lamp, olive, sock, apple, mango, garage, grave, nest, ball, star, glass

Noncognates: net, suitcase, fork, pear, plate, basket, candle, bowl, truck, cloud, bucket, spoon

Pseudowords: rusy, secord, aurt, noval, cit, glose, furk, terple, arp, ornage, swood, seneter

Nonwords: bkone, trse, mktor, dedt, dfor, tfirn, hkanket, brogk, buptet, clopg, zrcumber, kdower

List of items used in the Experiment 2 with L1 Croatian

Cognates: compass, balcony, lamp, balloon, taxi, microphone, album, grave, banana, magnet, garage, guitar, microscope, paper, aquarium, radio

Noncognates: olive, hammer, sock, honey, house, sword, book, ship, stone, hat, carrot, comb, glass, net, boat, bread

Pseudowords: logec, tigur, lunopac, slekšir, linah, vogra, žlota, teljina, pinla, ceslo, kajobran, eklin, stuz, gakva, nabonča, odusač

Nonwords: krutp, grćla, svne, zrcumber, mapbil, glhar, rugž, kožš, flkva, zđrno, mlrsec, rdktus, fmput, zdno, mečža, kapfra

List of items used in the Experiment 2 with L1 Spanish

Cognates: chocolate, violin, coffee, potato, ambulance, tractor, pizza, telephone, taxi, camera, lemon, wine, tomato, bicycle, train, rose

Noncognates: mirror, cucumber, book, chair, onion, ship, spoon, knife, iron, pencil, watch, apple, carrot, fork, wardrobe, glass

Pseudowords: tiesno, cohu, bumbre, motunto, zindo, miger, permaná, trabape, famera, otemplo, pusabra, confación, daerta, lavimiento, expatencia, regiltado

Nonwords: aclecto, servispo, duln, spestión, mañalt, smecto, odbeto, slor, sisteng, sueld, respemno, libegdad, ertuerzo, mienz, mimrto, pogrant

List of items used in the Experiment 2 with L1 German

Cognates: banana, mango, honey, apple, olive, ball, hammer, lamp, tractor, garage, walnut, star

Noncognates: stain, candle, plate, truck, basket, bucket, fork, pear, suitcase, bowl, cloud, spoon

Pseudowords: rusy, secord, aurt, noval, cit, glose, furk, terple, arp, ornage, swood, seneter

Nonwords: bkone, trse, mktor, dedt, dfor, tfirn, hkanket, brogk, buptet, clopg, zrcumber, kdower

Appendix A: II – Main experiment

Experiment 1: L1 German visual world sentences

Cognate match:

1. The banana will be peeled by the doctor.

She is across the table.

The doctor needs to go to the other end of the table to grab the banana.

2. The lamp will be turned on by the grandma.

She is at the other end of the room.

The grandma should walk to the lamp to turn it on.

3. The olive will be eaten by the nurse.

She is across the canal.

The nurse should cross the canal to reach the olive.

4. The sock will be smelled by the clown.

She is on the other side of the door.

The clown must open the door to get to the sock.

5. The apple will be ground by the thief.

He is across the field.

The thief has to get to the other field to reach the apple.

6. The mango will be sliced by the maid.

She is on the other side of the river.

The maid may cross the river to reach the mango.

Cognate mismatch:

7. The garage will be cleaned by the mechanic.

He is on the other side of the fence.

The mechanic ought to jump the fence to reach the garage.

8. The grave will be visited by the dancer.

She is on the other side of the hill.

The dancer has to run over the hill to reach the grave.

9. The nest will be fixed by the grandpa.

He is at the other side of the bridge.

The grandpa has to walk over the bridge to take the nest.

10. The ball will be kicked by the skier.

She is across the road.

The skier needs to cross the road to reach the ball.

11. The star will be observed by the teacher.

She is on the other side of the wall.

The teacher can go around the wall to look at the star.

12. The glass will be broken by the judge.

He is at the other end of the rug.

The judge needs to walk over the rug to get to the glass.

Noncognate match:

13. The net stain will be removed by the chauffeur.

He is at the other side of the bridge.

The chauffer ought to cross the bridge to get to the net stain.

14. The suitcase will be found by the man.

He is on the other side of the bed.

The man may walk to the other side of the bed to get the suitcase.

15. The fork will be polished by the gymnast.

She is in the other corner.

The gymnast has to cross the room to get to the fork.

16. The pear will be snatched by the woman.

She is on the other island.

The woman should swim to the other island to reach the pear.

17. The plate will be painted by the professor.

He is across the fence.

The professor has to cross the fence to take the plate.

18. The basket will be bought by the groom.

He is in the other room.

The groom has to open the door to reach the basket.

Noncognate mismatch:

19. The candle will be blown out by the priest.

He is at the other end of the room.

The priest needs to cross the room to get to the candle.

20. The bowl will be washed by the policeman.

He is at the other end of the table.

The policeman should get to the other end of the table to take the bowl.

21. The truck will be sold by the pilot.

She is in the other field.

The pilot must cross the field to get to the truck.

22. The cloud will be admired by the eskimo.

He is on the other end of the hill.

The eskimo needs to walk over the hill to see the cloud.

23. The bucket will be emptied by the graduate.

She is across the pond.

The graduate should walk around the pond to get to the bucket.

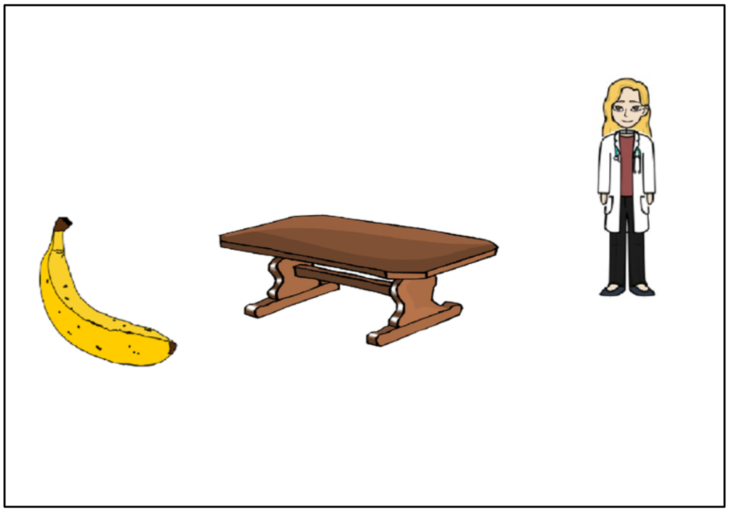
24. The spoon will be bent by the wife.

She is across the path.

The wife needs to cross the path to reach the spoon.

Experiment 1: L1 German visual world pictures

Cognate match:



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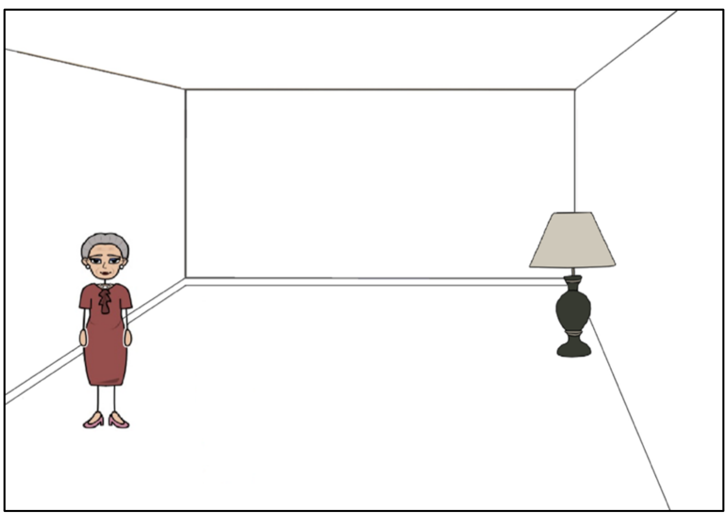
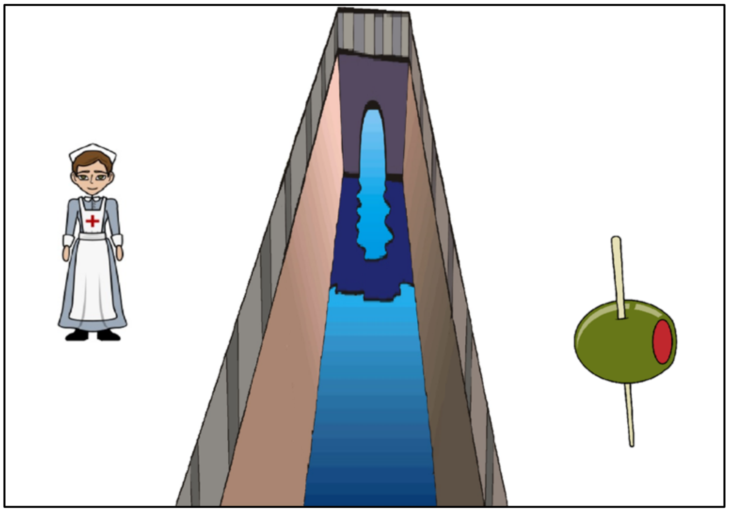
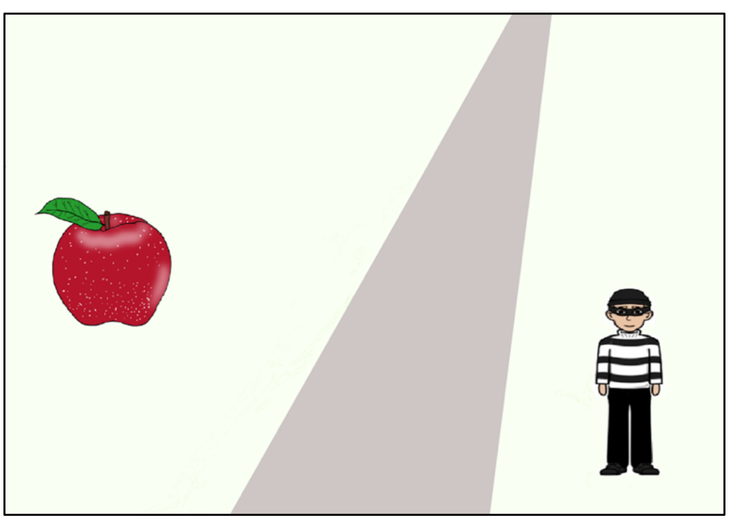


2.

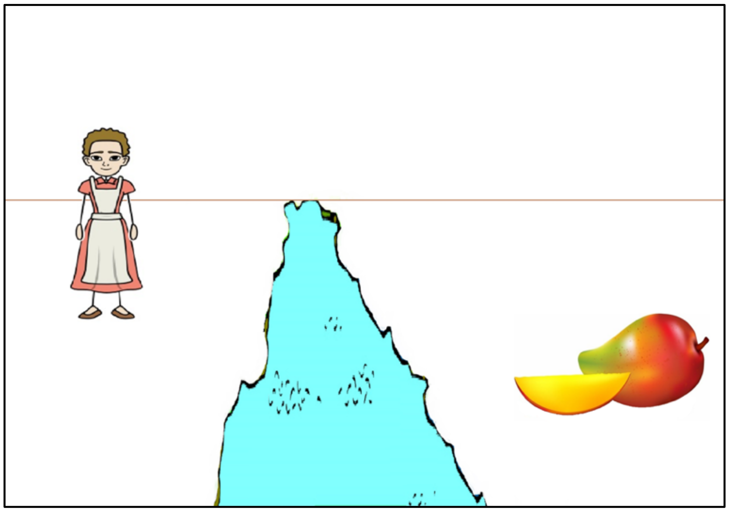


3.

4.

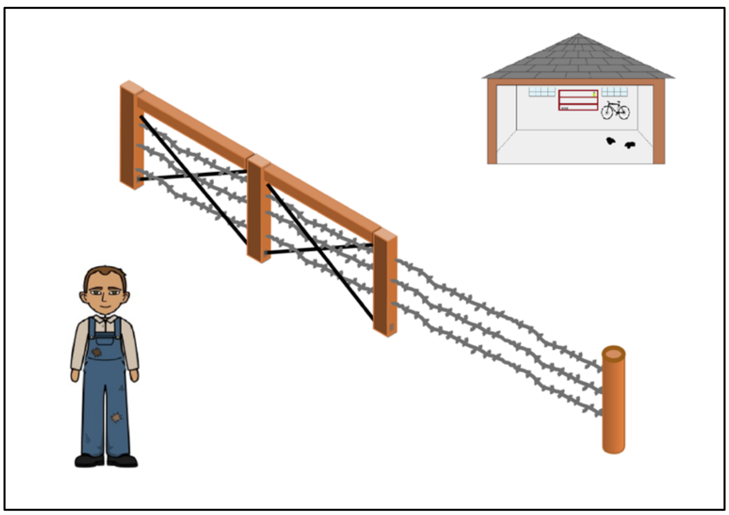


5.

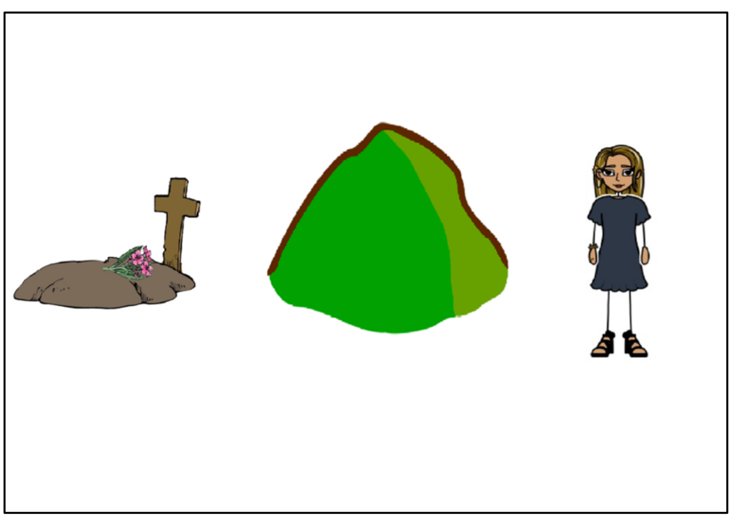


6.

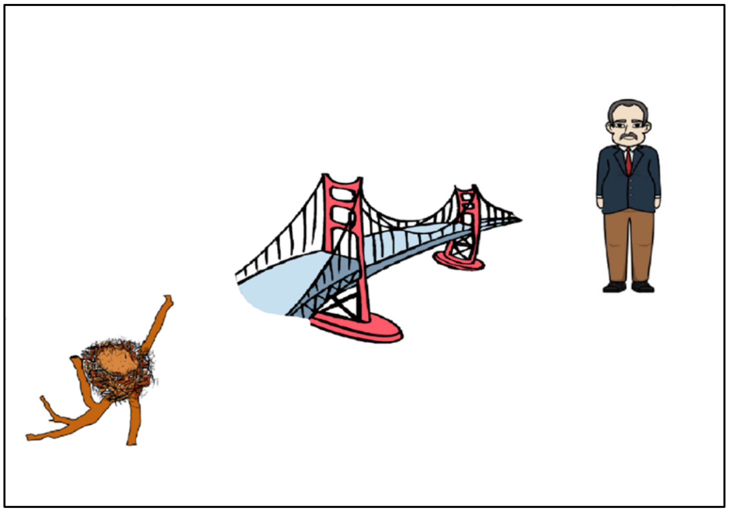
Cognate mismatch:

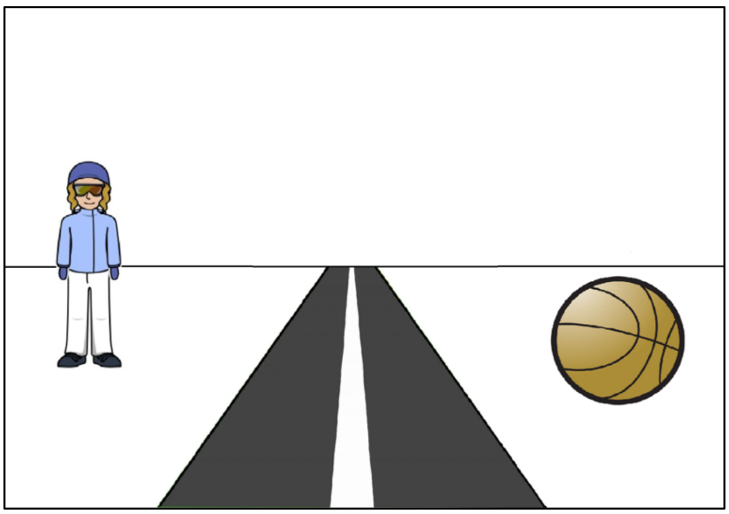


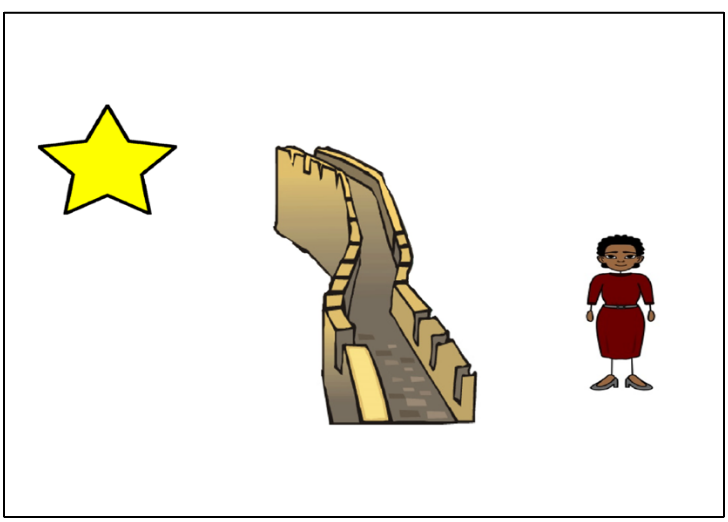
7.



8.


9.


10.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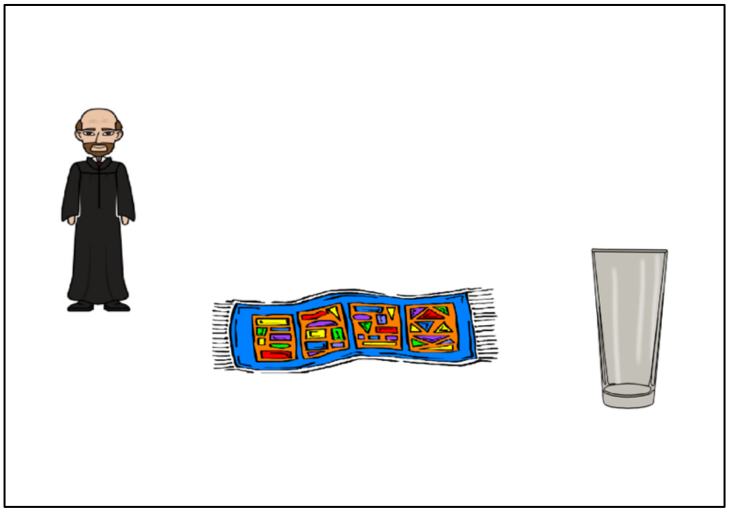
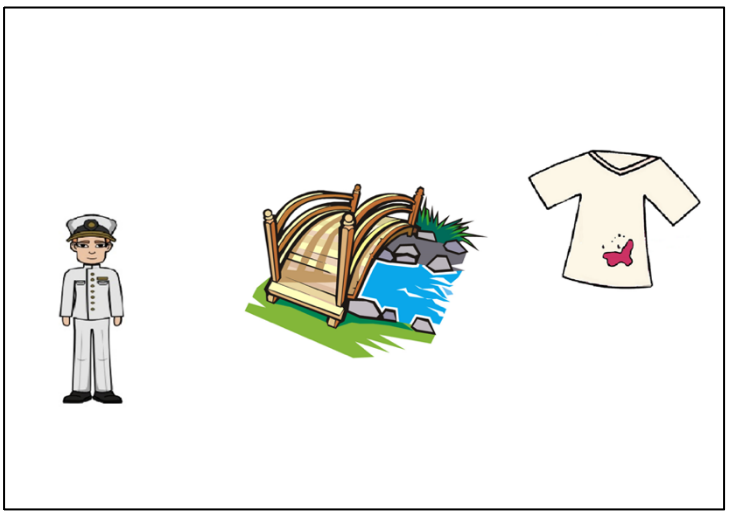

12.

Noncognate match: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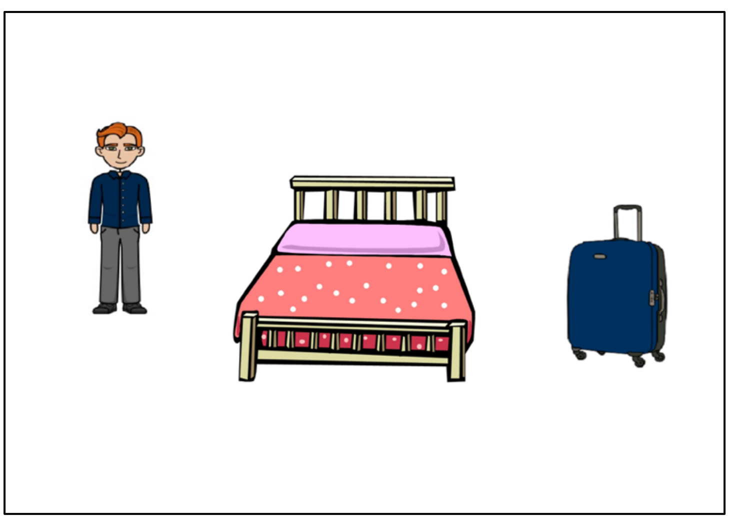
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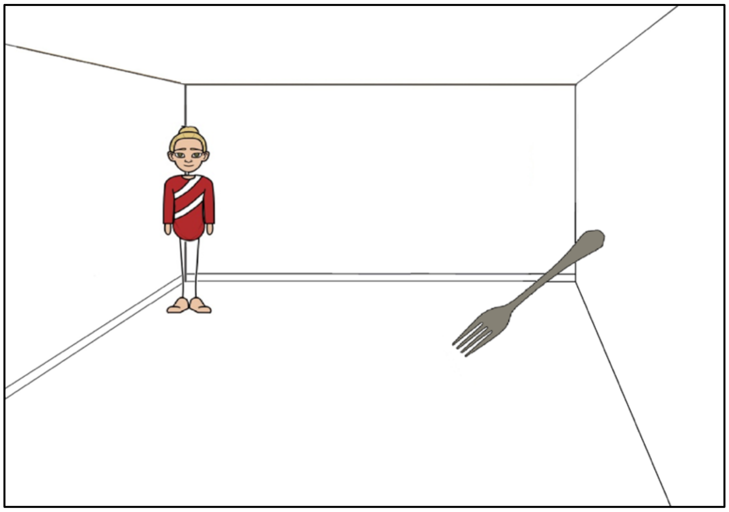

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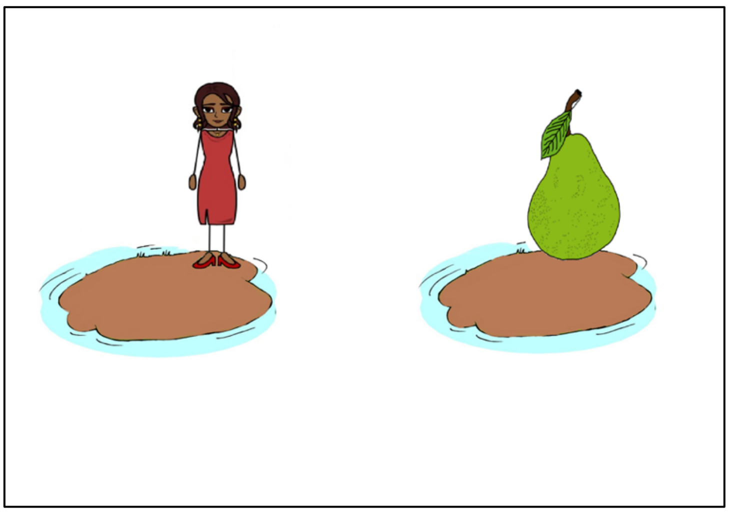
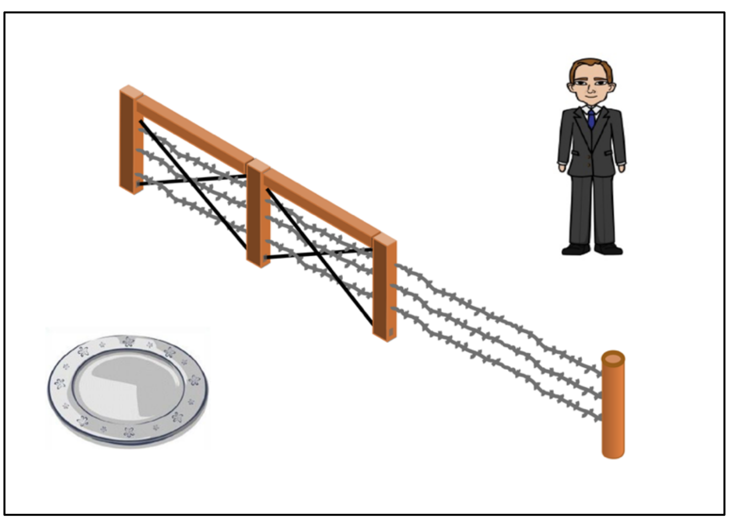
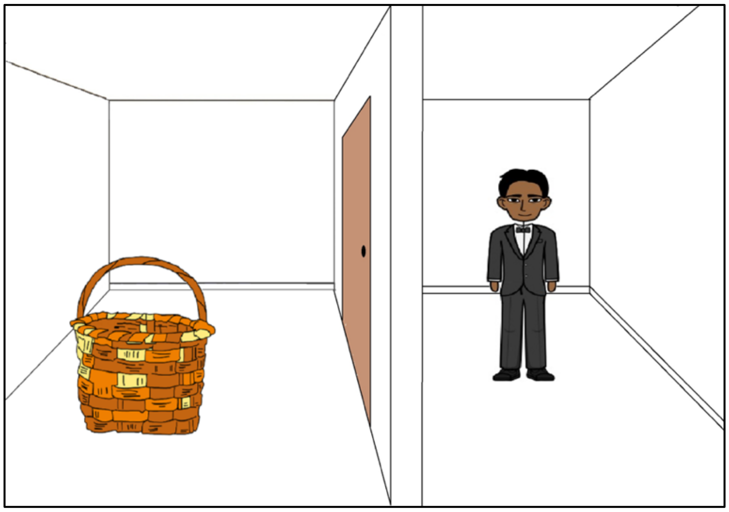


16.

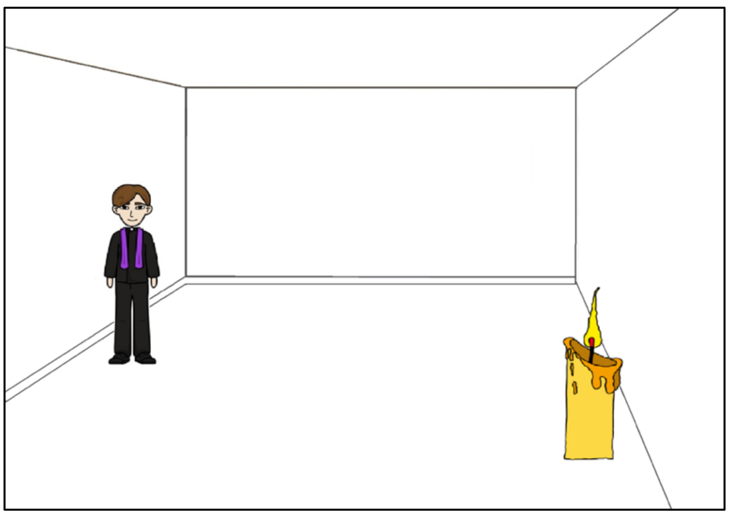


17.

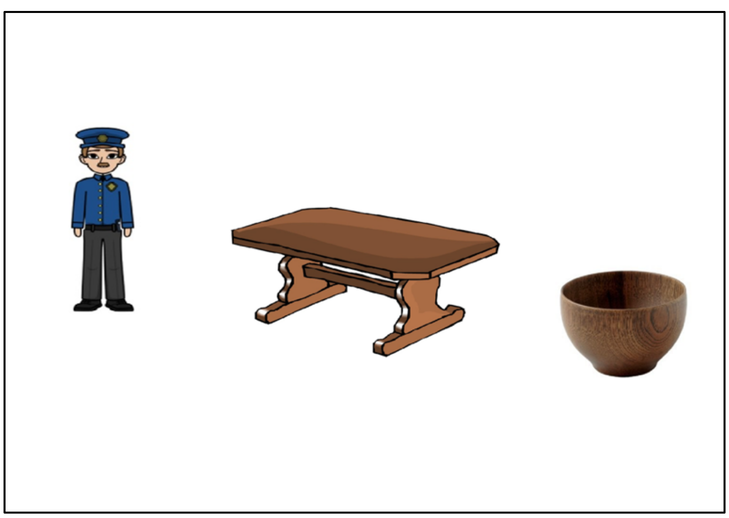


18.

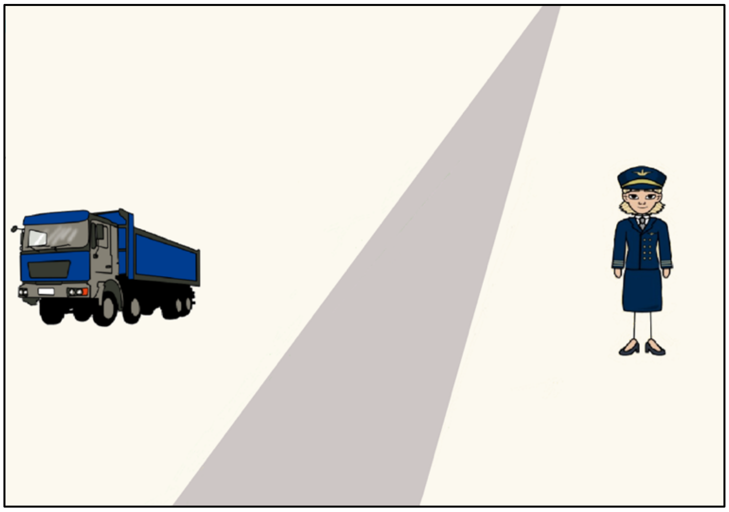
Noncognate mismatch:

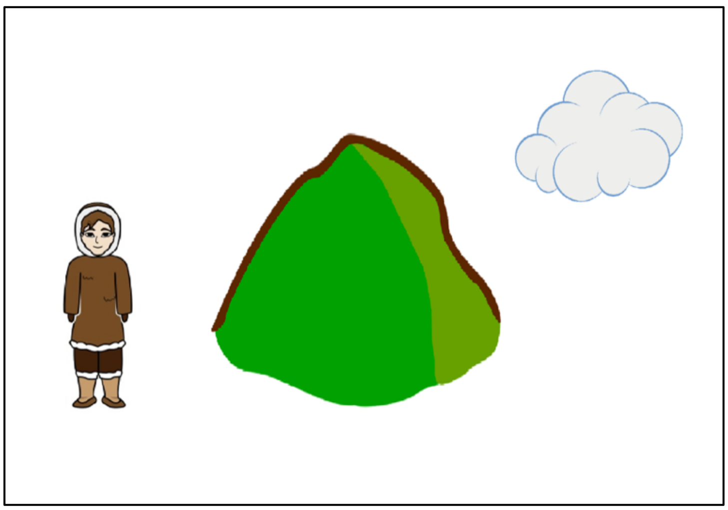


19.



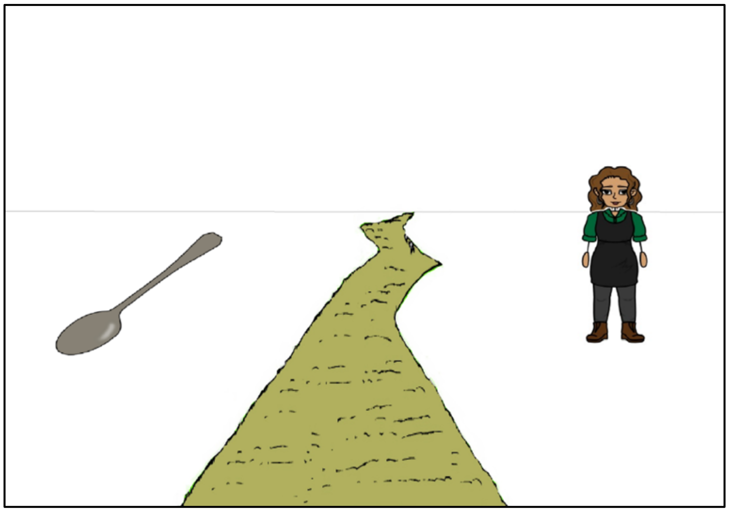
20.


21.


22.


23.

24.



Experiment 2: L1 Croatian visual world sentences

LIST 1

Cognate match:

1. Kompas će biti ukraden od strane lopova.

He is in the other field.

The thief has to cross the road to get to the compass.

2. Balkon će biti posećen od strane farmera.

He is on the other side of the bench.

The farmer may walk to the other side of the bench to get to the balcony.

3. Lampa će biti upaljena od strane starice.

She is at the other end of the room.

The grandma should walk to the lamp to turn it on.

4. Balon će biti zgrabljen od strane muškarca.

He is on the other island.

The man should swim to the other island to reach the balloon.

5. Taksi će biti vožen od strane gospodina.

He is on the other side of the road.

The gentleman has to cross the road to enter the taxi.

6. Mikrofon će biti popravljen od strane starca.

He is at the other side of the bridge.

The grandpa has to walk over the bridge to take the microphone.

7. Album će biti podignut od strane pravnika.

He is at the other end of the rug.

The attorney needs to walk to the other end of the rug to grab the album.

8. Grob će biti posećen od strane plesača.

He is on the other side of the hill.

The dancer has to run over the hill to reach the grave.

Cognate mismatch:

9. Banana će biti oljuštena od strane doktora.

He is across the table.

The doctor needs to go to the other end of the table to grab the banana.

10. Magnet će biti pokupljen od strane čistačice.

She is in the other room.

The maid must open the door to get to the magnet.

11. Garaža će biti očišćena od strane mehaničara.

He is on the other side of the fence.

The mechanic ought to jump the fence to reach the garage.

12. Gitara će biti kupljena od strane mladoženje.

He is in the other room.

The groom has to open the door to reach the guitar.

13. Mikroskop će biti posmatran od strane eskimoa.

She is on the other end of the hill.

The eskimo needs to walk over the hill to see the microscope.

14. Papir će biti obojen od strane studentkinje.

She is across the fence.

The graduate has to cross the fence to take the paper.

15. Akvarijum će biti ispražnjen od strane učiteljice.

She is across the pond.

The teacher should walk around the pond to get to the acquarium.

16. Radio će biti istražen od strane stjuardese.

She is on the other side of the hedge

The stewardess might jump the hedge to get to the radio.

Noncognate match:

17. Maslina će biti pojedena od strane medicinske sestre.

She is across the canal.

The nurse should cross the canal to reach the olive.

18. Čekić će biti zakopan od strane osuđenika.

He is on the other side of the bridge.

The convict may cross the bridge to reach the hammer.

19. Čarapa će biti pomirisana od strane majke.

She is on the other side of the door.

The mother must open the door to get to the sock.

20. Med će biti pokupljen od strane boksera.

He is in the other area.

The boxer needs to jump the fence to reach the honey.

21. Kuća će biti očišćena od strane kaluđerice.

She is across the path.

The nun has to cross the path to reach the house.

22. Mač će biti obrisan od strane hirurga.

He is at the other end of the room.

The surgeon has to cross the room to reach the sword.

23. Knjiga će biti pronađena od strane žene.

She is on the other side of the bed.

The wife may walk to the other side of the bed to get to the book.

24. Brod će biti uglancan od strane vojnika.

He is in the other corner.

The soldier has to cross the room to get to the ship.

Noncognate mismatch:

25. Kamen će biti pomeren od strane klizačice.

She is across the path.

The skater should cross the path to get to the stone.

26. Šešir će biti uzet od strane kuvarice.

She is across the path.

The chef should cross the path to take the hat.

27. Šargarepa/mrkva će biti iseckana od strane atletičara.

He is on the other side of the river.

The athlete may cross the river to reach the carrot.

28. Češalj će biti upotrebljen od strane mlade.

She is at the other end of the room.

The bride ought to cross the room to take the comb.

29. Čaša će biti polomljena od strane sudije.

He is at the other end of the rug.

The judge needs to walk over the rug to get to the glass.

30. Mreža će biti sklonjena od strane šofera.

He is at the other side of the bridge.

The chauffer ought to cross the bridge to get to the net.

31. Čamac će biti analiziran od strane naučnice.

She is on the other side of the bench.

The scientist might walk past the bench to get to the boat.

32. Hleb će biti proban od strane sekretarice.

She is on the other side of the bed.

The secretary needs to go to the other side of the bed to take the bread.

LIST 2

Cognate match:

1. Banana će biti oljuštena od strane doktorke.

She is across the table.

The doctor needs to go to the other end of the table to grab the banana.

2. Magnet će biti pokupljen od strane pilota.

He is in the other room.

The pilot must open the door to get to the magnet.

3. Garaža će biti očišćena od strane mehaničarke.

She is on the other side of the fence.

The mechanic ought to jump the fence to reach the garage.

4. Gitara će biti kupljena od strane mlade.

She is in the other room.

The bride has to open the door to reach the guitar.

5. Mikroskop će biti posmatran od strane eskimoa.

He is on the other end of the hill.

The eskimo needs to walk over the hill to see the microscope.

6. Papir će biti obojen od strane studenta.

He is across the fence.

The graduate has to cross the fence to take the paper.

7. Akvarijum će biti ispražnjen od strane učitelja.

He is across the pond.

The teacher should walk around the pond to get to the acquarium.

8. Radio će biti istražen od strane stjuarta.

He is on the other side of the hedge.

The steward might jump the hedge to get to the radio.

Cognate mismatch:

9. Kompas će biti ukraden od strane lopova.

She is in the other field.

The thief has to cross the road to get to the compass.

10. Balkon će biti posećen od strane gimnastičarke.

She is on the other side of the bench.

The gymnast may walk to the other side of the bench to get to the balcony.

11. Lampa će biti upaljena od strane starca.

He is at the other end of the room.

The grandpa should walk to the lamp to turn it on.

12. Balon će biti zgrabljen od strane žene.

She is on the other island.

The woman should swim to the other island to reach the balloon.

13. Taksi će biti vožen od strane dame.

She is on the other side of the road.

The lady has to cross the road to enter the taxi.

14. Mikrofon će biti popravljen od strane starice.

She is at the other side of the bridge.

The grandma has to walk over the bridge to take the microphone.

15. Album će biti podignut od strane sekretarice.

She is at the other end of the rug.

The secretary needs to walk to the other end of the rug to grab the album.

16. Grob će biti posećen od strane plesačice.

She is on the other side of the hill.

The dancer has to run over the hill to reach the grave.

Noncognate match:

17. Kamen će biti pomeren od strane klizača.

He is across the path.

The skater should cross the path to get to the stone.

18. Šešir će biti uzet od strane kuvara.

He is across the path.

The chef should cross the path to take the hat.

19. Mrkva će biti iseckana od strane atletičarke.

She is on the other side of the river.

The athlete may cross the river to reach the carrot.

20. Češalj će biti upotrebljen od strane mladoženje.

He is at the other end of the room.

The groom ought to cross the room to take the comb.

21. Čaša će biti polomljena od strane navijačice.

She is at the other end of the rug.

The cheerleader needs to walk over the rug to get to the glass.

22. Mreža će biti sklonjena od strane plivačice.

She is at the other side of the bridge.

The swimmer ought to cross the bridge to get to the net.

23. Čamac će biti analiziran od strane naučnika.

He is on the other side of the bench.

The scientist might walk past the bench to get to the boat.

24. Hleb će biti proban od strane sekretara.

He is on the other side of the bed.

The secretary needs to go to the other side of the bed to take the bread.

Noncognate mismatch:

25. Maslina će biti pojedena od strane medicinskog tehničara.

He is across the canal.

The nurse should cross the canal to reach the olive.

26. Čekić će biti zakopan od strane balerine.

She is on the other side of the bridge.

The ballerina may cross the bridge to reach the hammer.

27. Čarapa će biti pomirisana od strane oca.

He is on the other side of the door.

The father must open the door to get to the sock.

28. Med će biti pokupljen od strane bokserke.

She is in the other area.

The boxer needs to jump the fence to reach the honey.

29. Kuća će biti očišćena od strane sveštenika.

He is across the path.

The priest has to cross the path to reach the house.

30. Mač će biti obrisan od strane boginje.

She is at the other end of the room.

The goddess has to cross the room to reach the sword.

31. Knjiga će biti pronađena od strane muža.

He is on the other side of the bed.

The husband may walk to the other side of the bed to get to the book.

32. Brod će biti uglancan od strane vojnika.

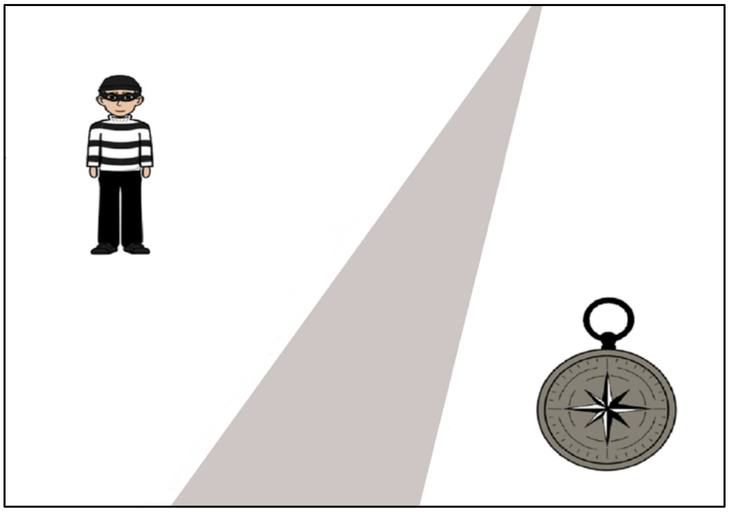
She is in the other corner.

The soldier has to cross the room to get to the ship.

Experiment 2: L1 Croatian visual world pictures

LIST 1

Cognate match:



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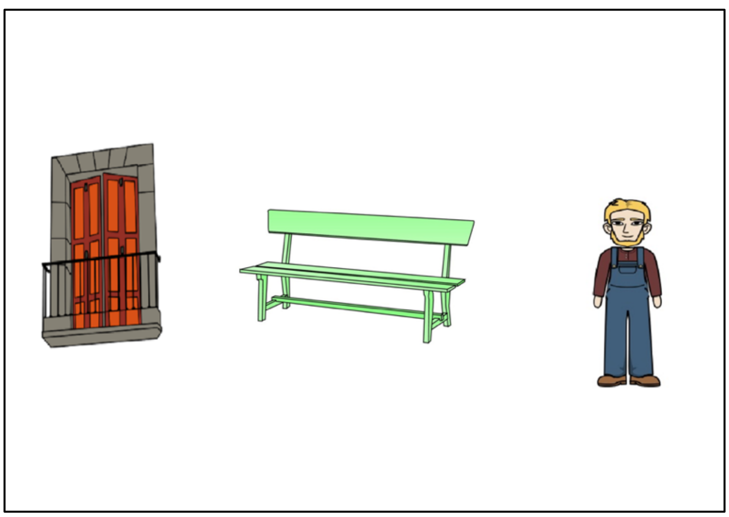

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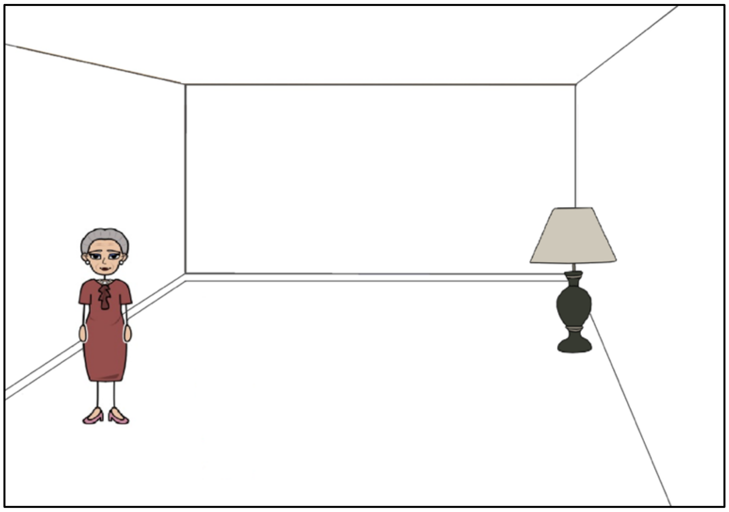

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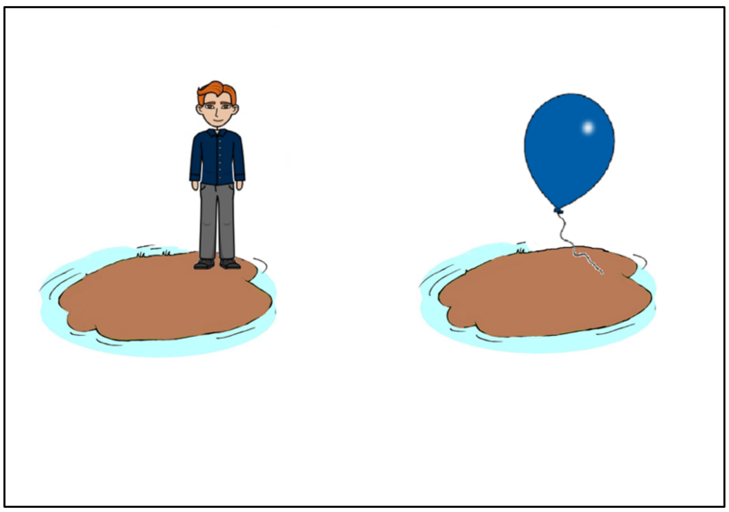

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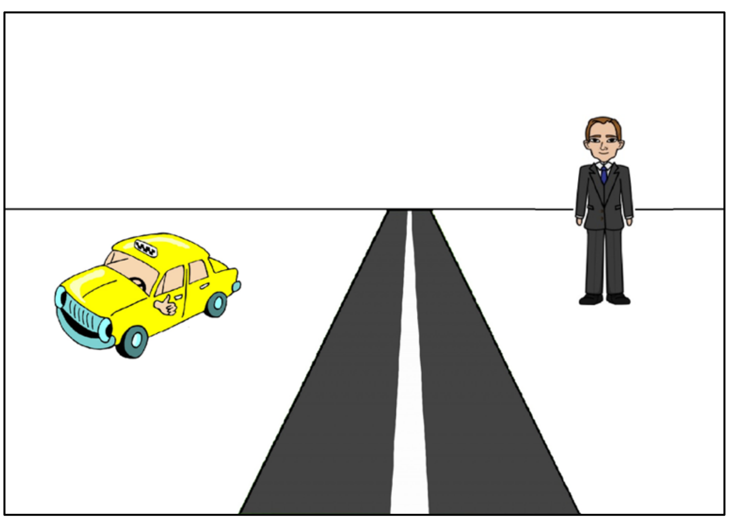

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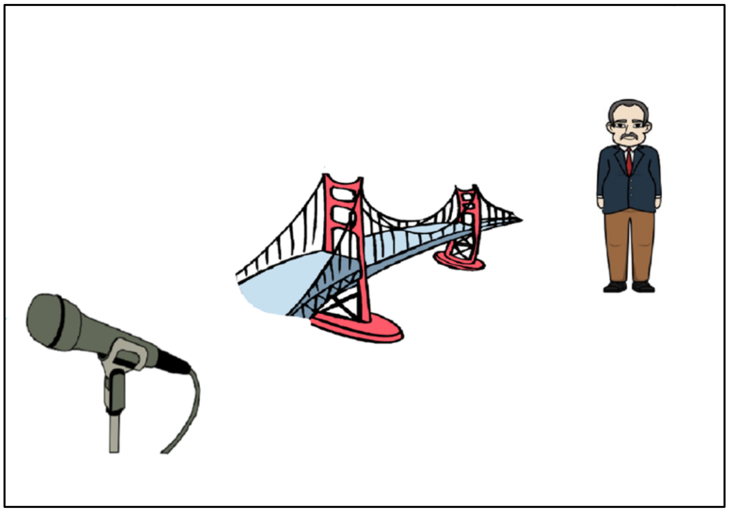

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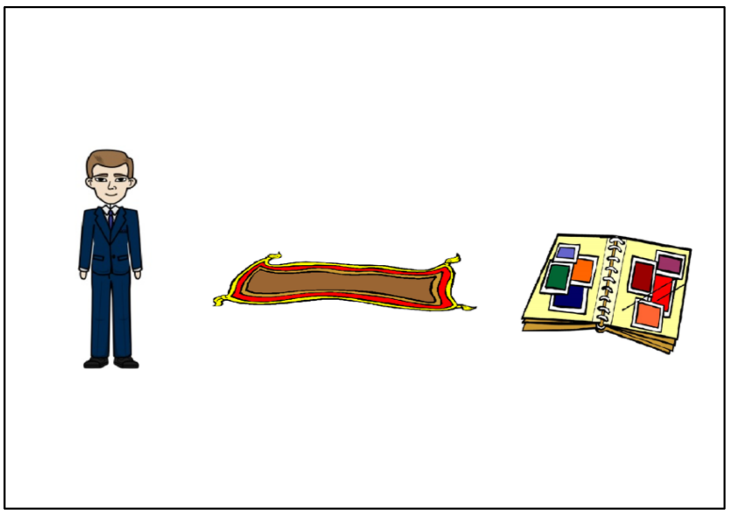

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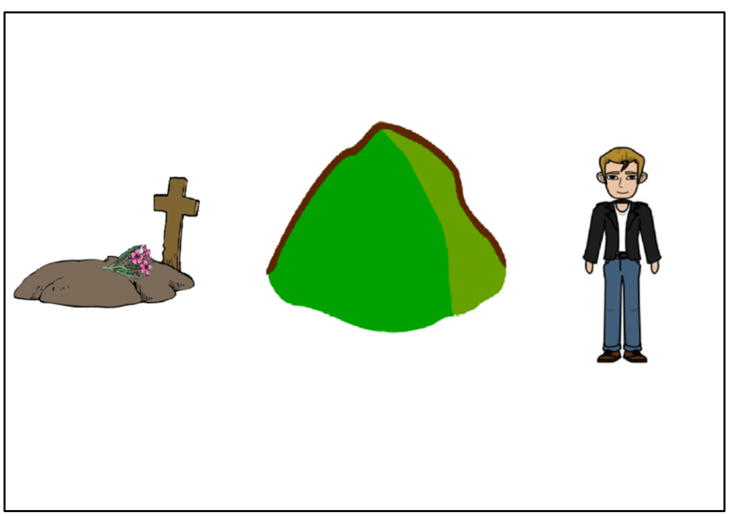
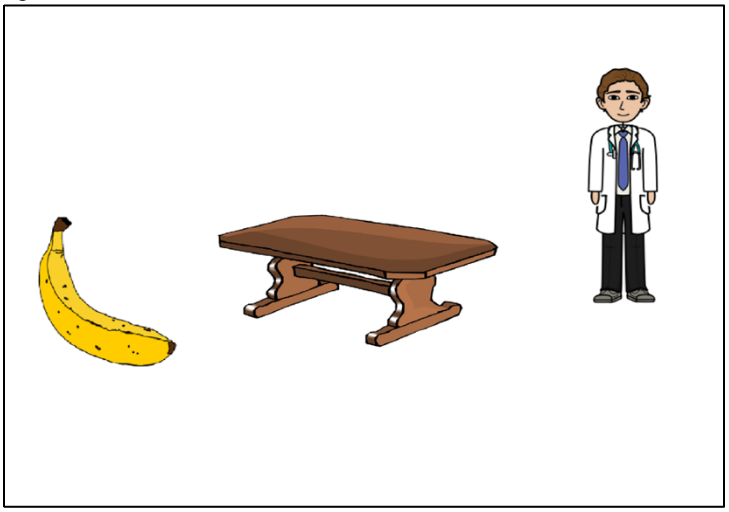


8.

Cognates mismatch:



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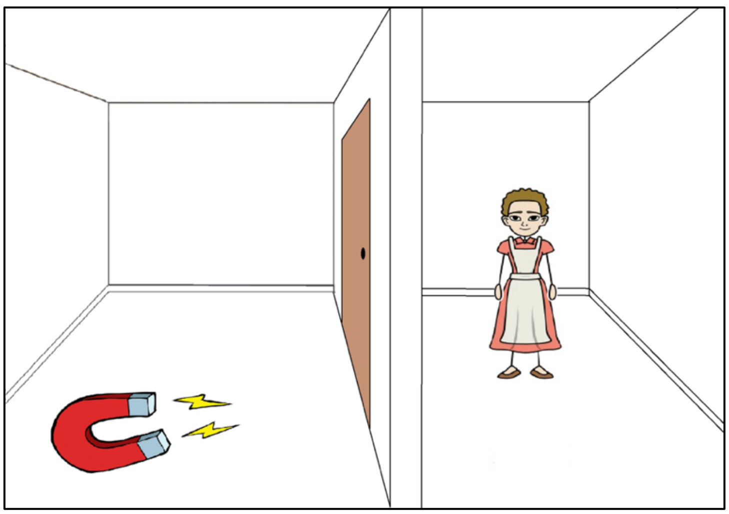

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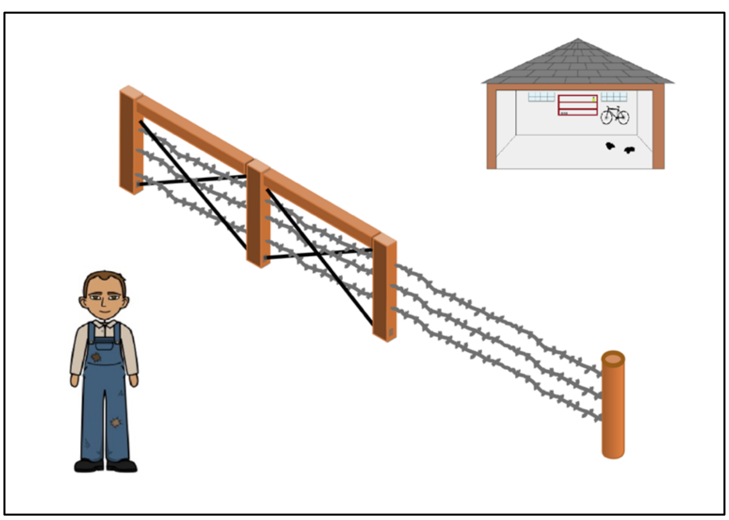

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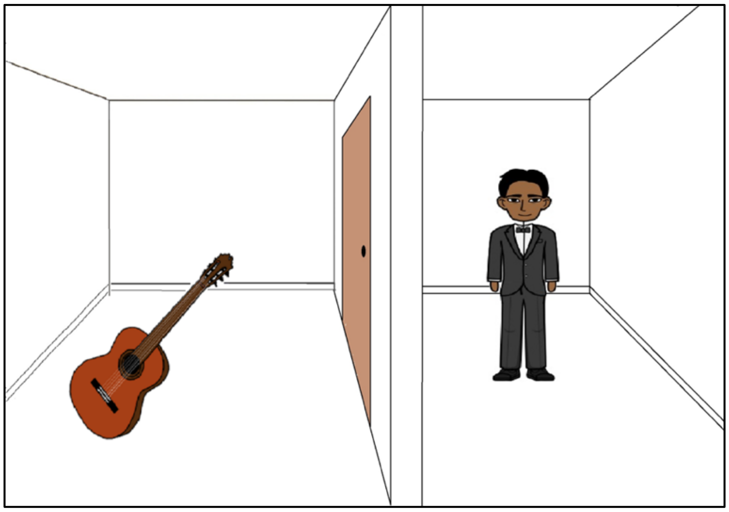

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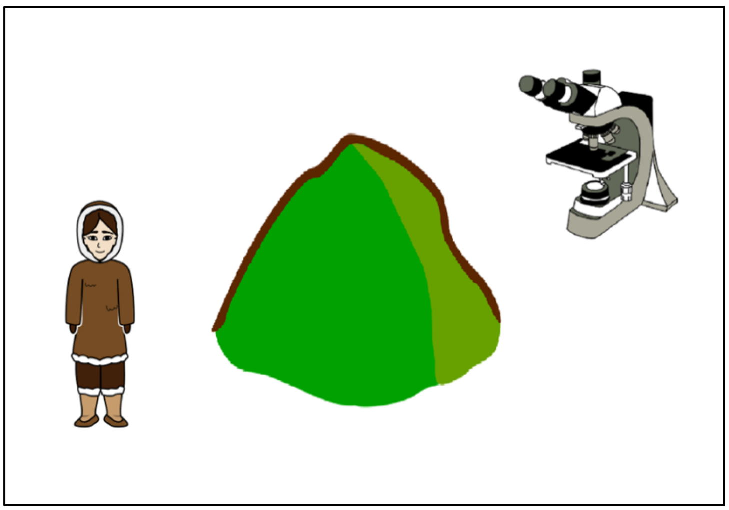

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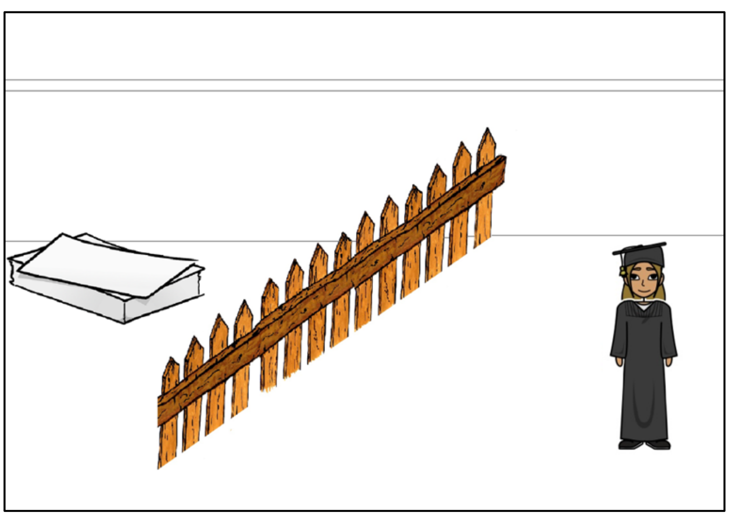

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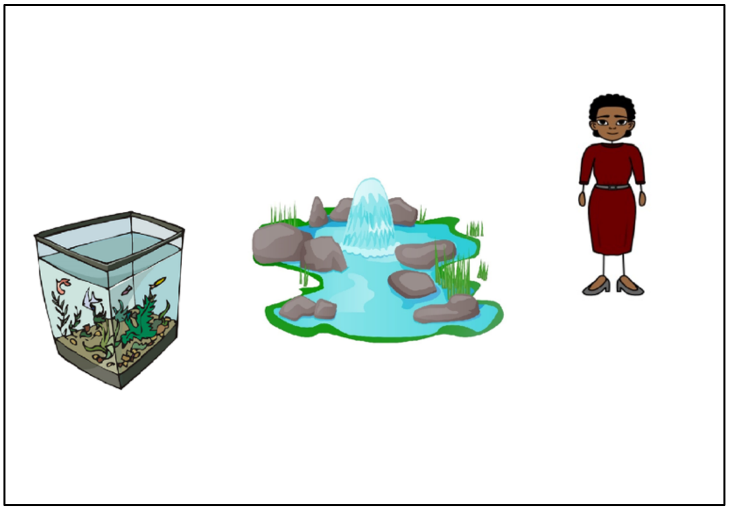
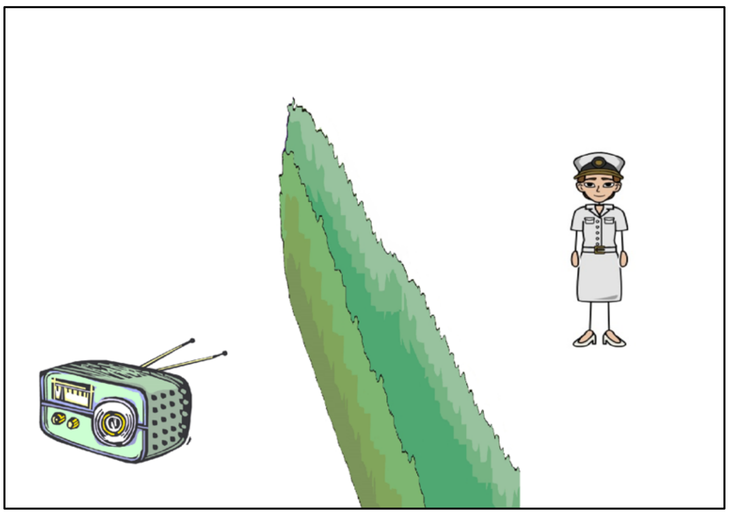
15. 

16. 

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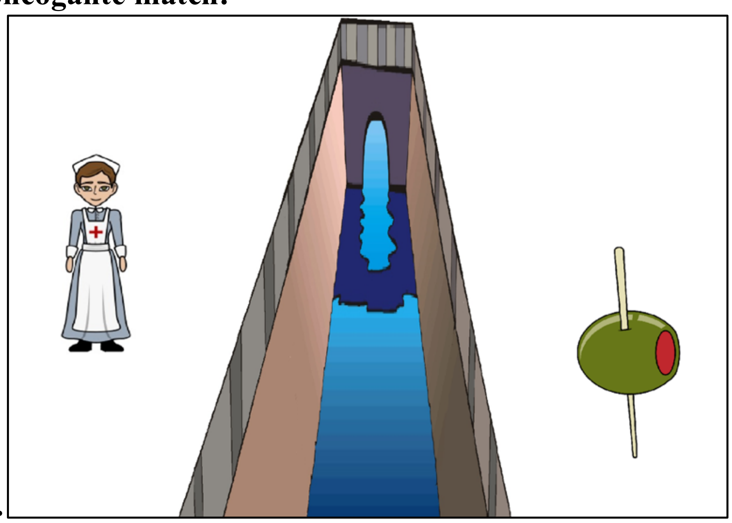
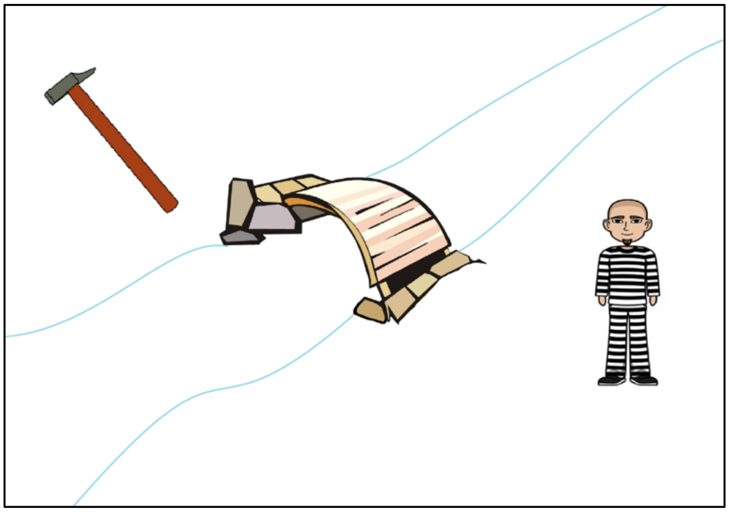
17. 



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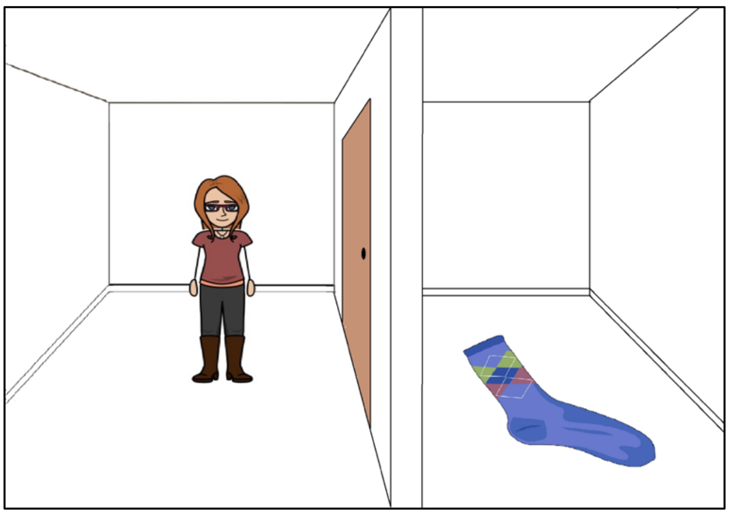

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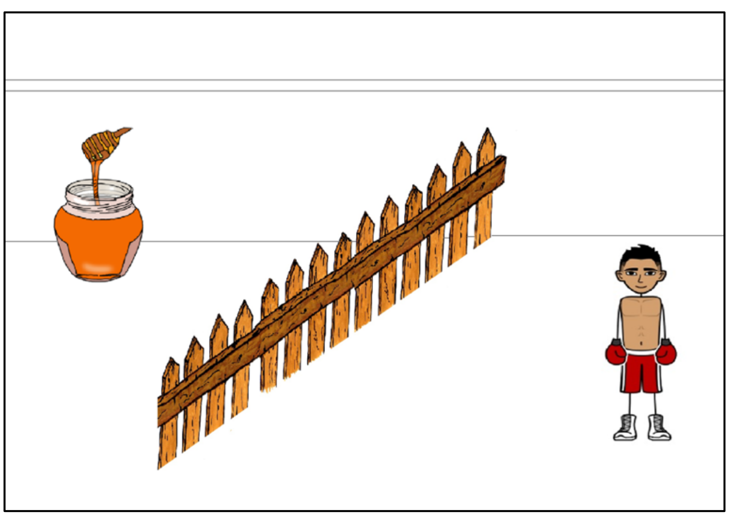

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21.

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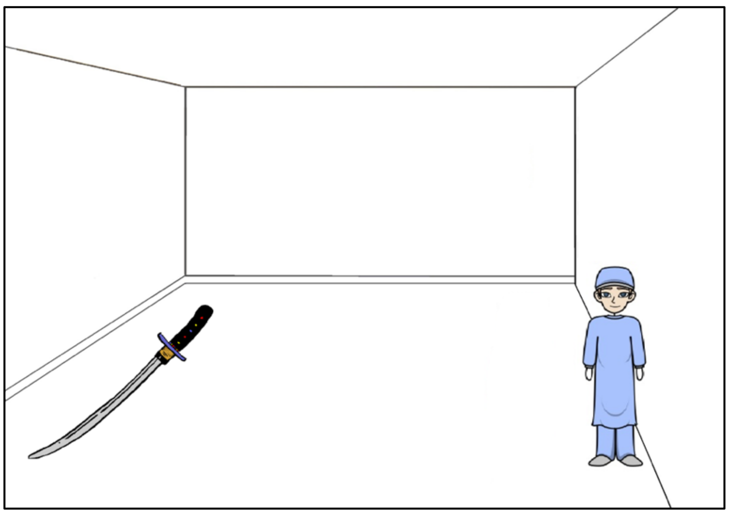

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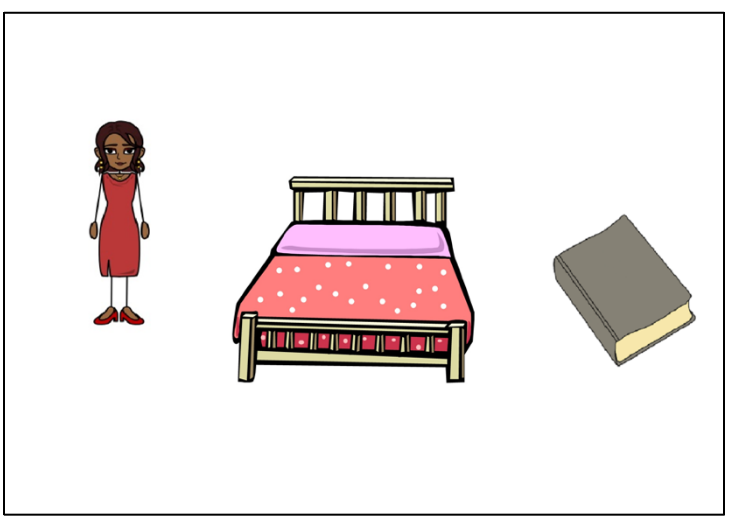

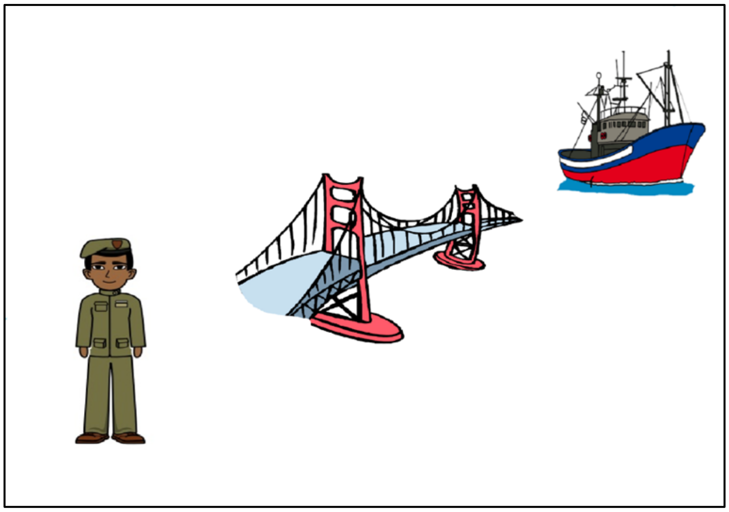

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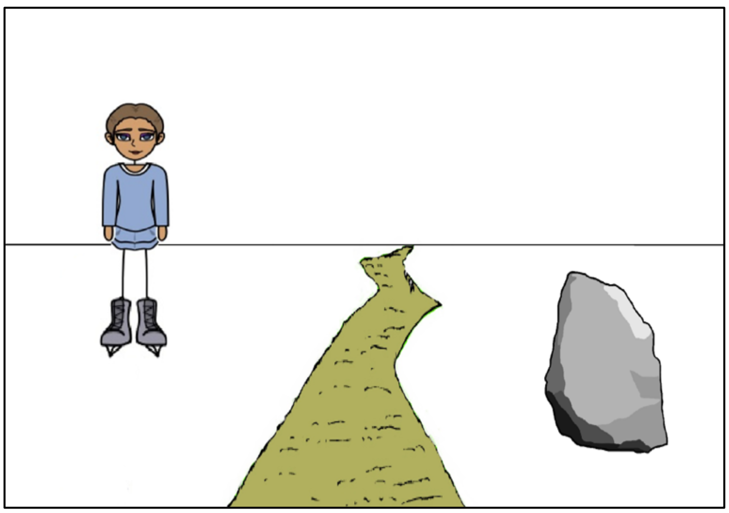

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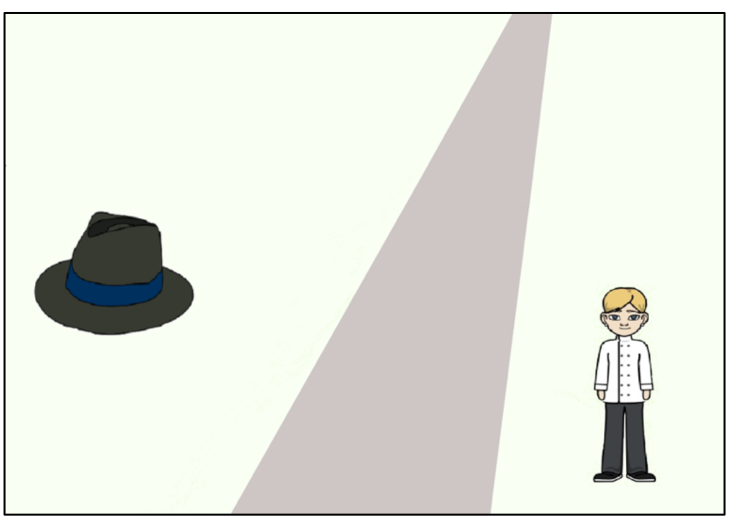

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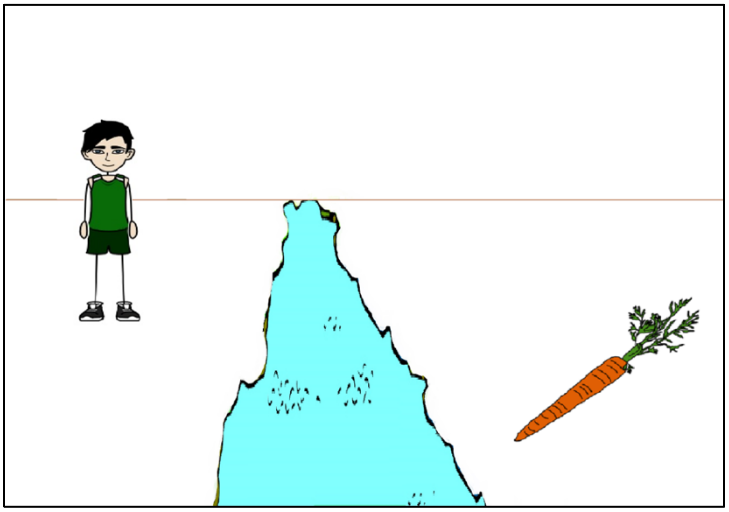

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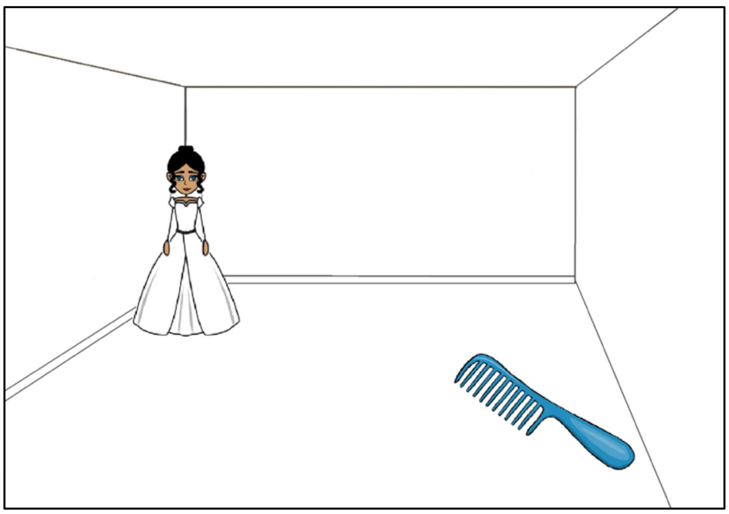

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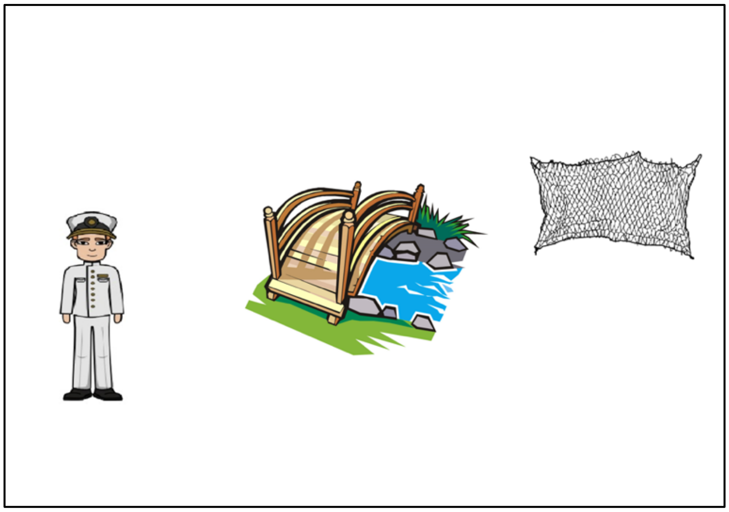

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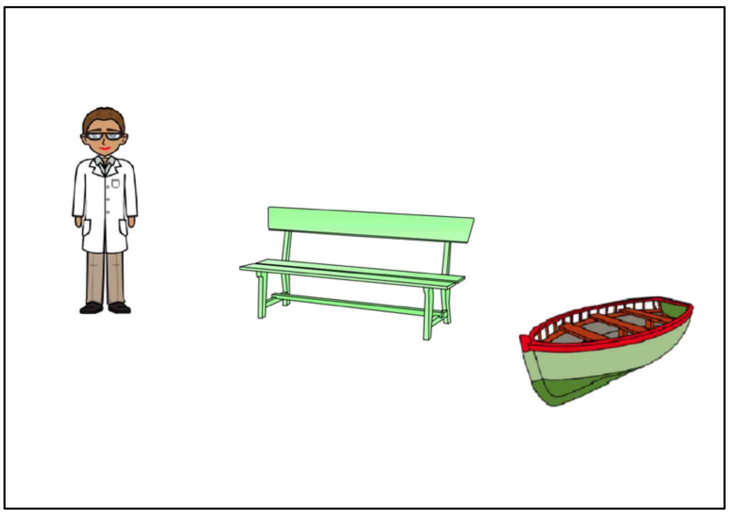

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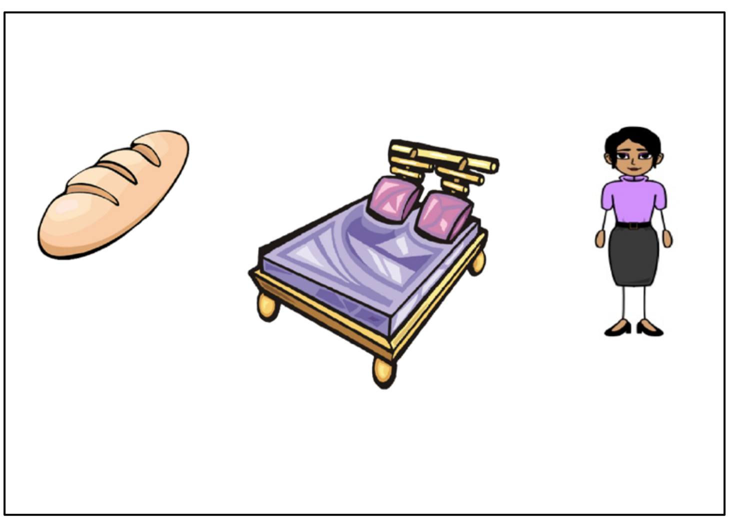
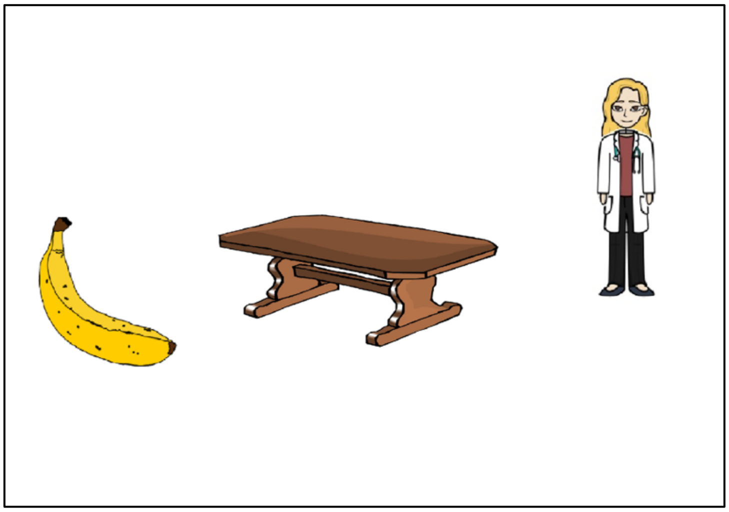


32.

LIST 2

Cognate match:



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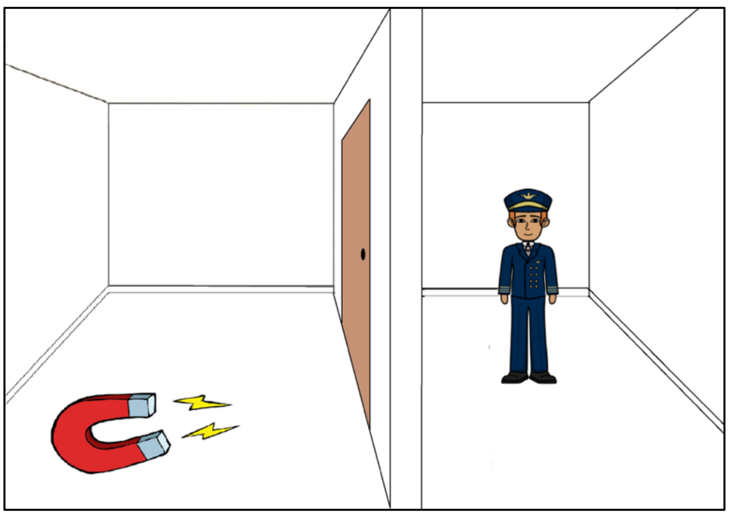

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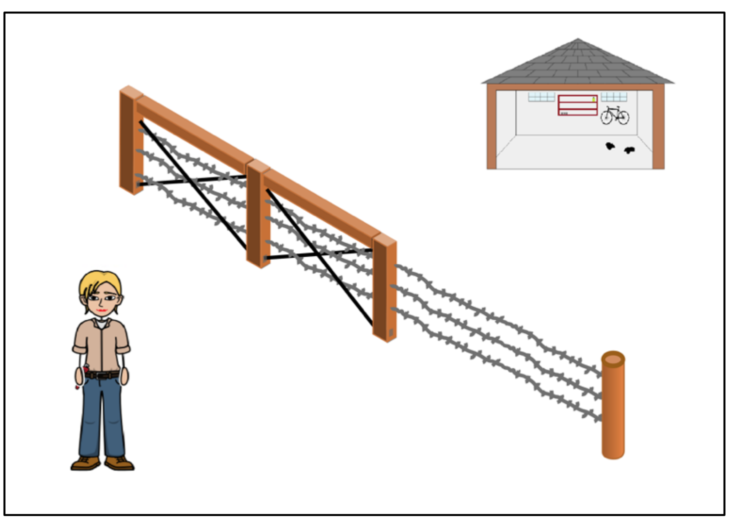

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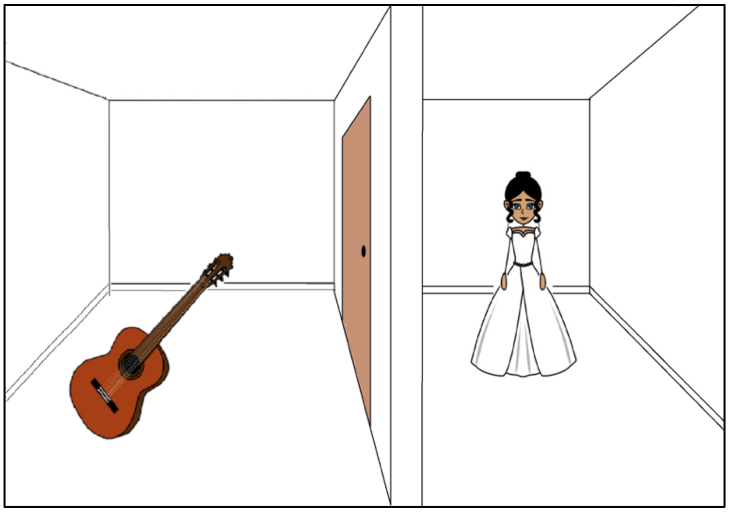

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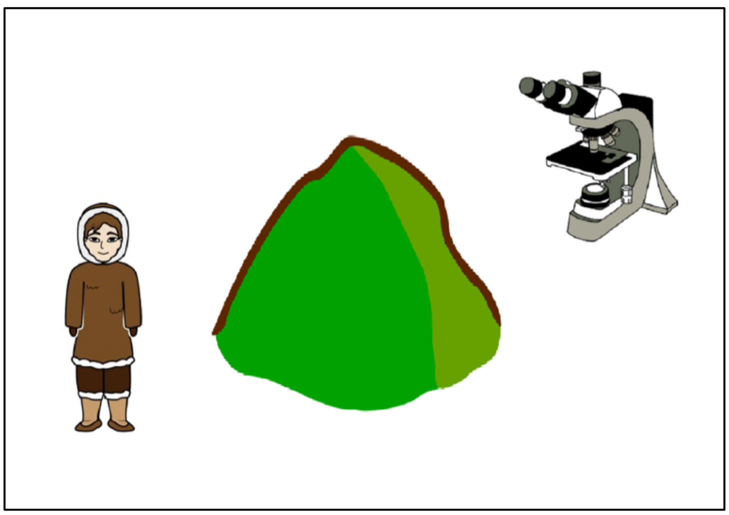

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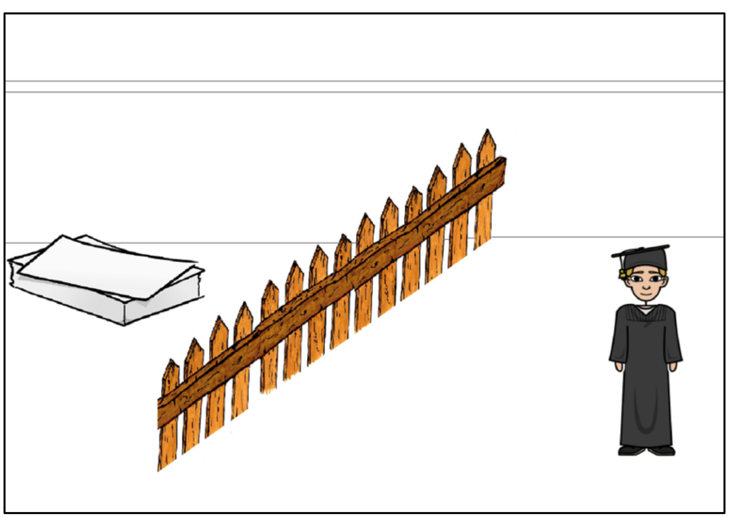

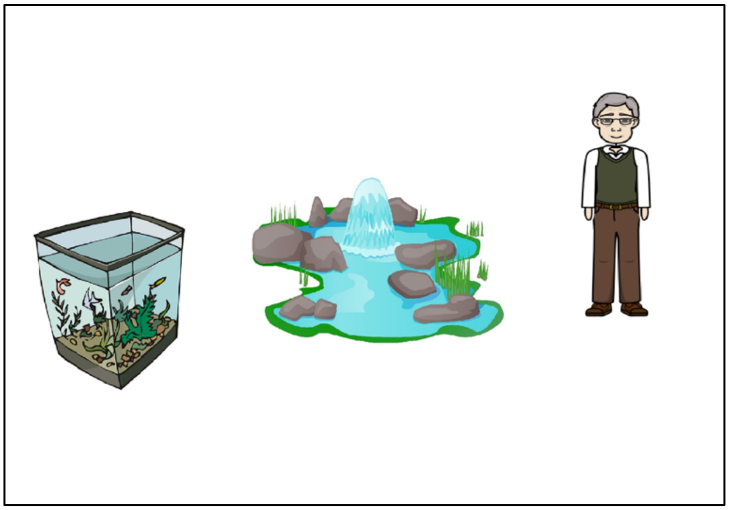
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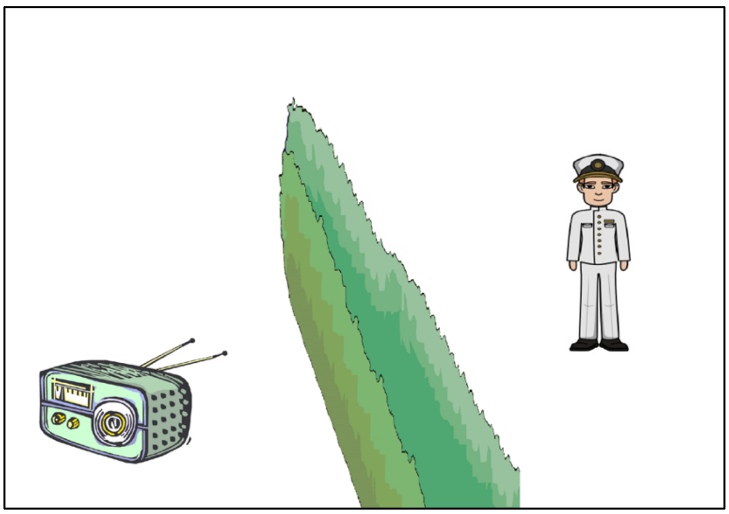
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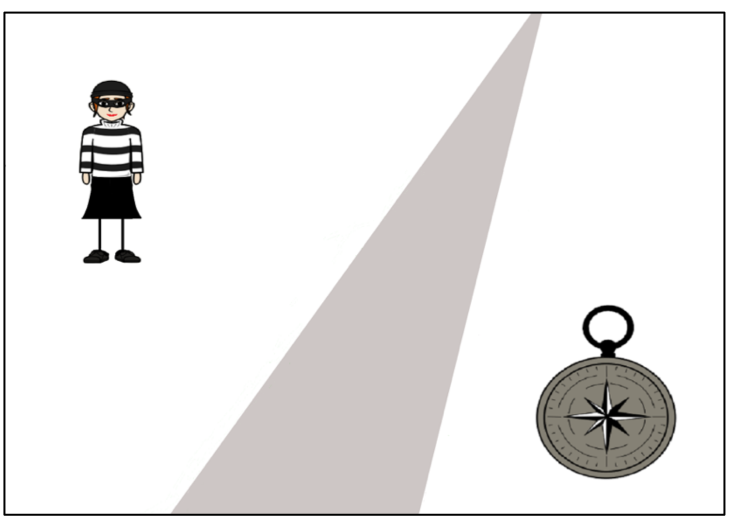
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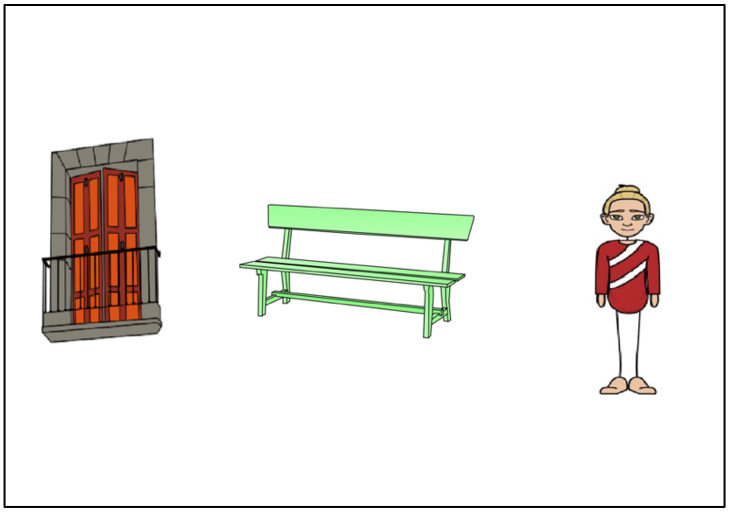

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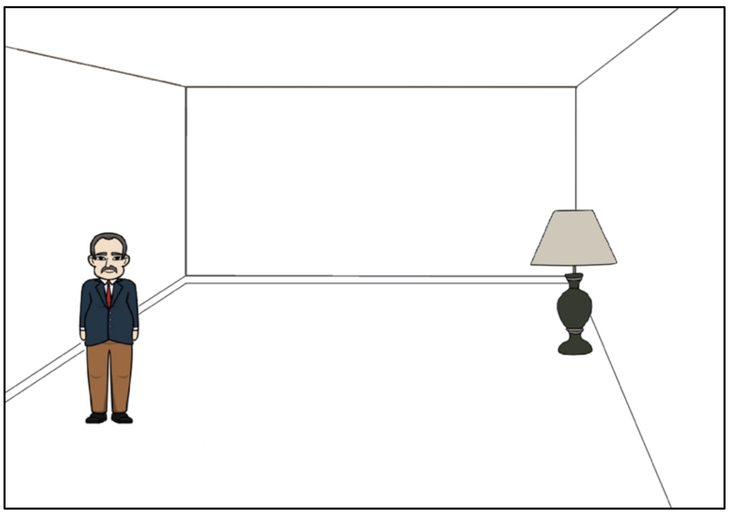

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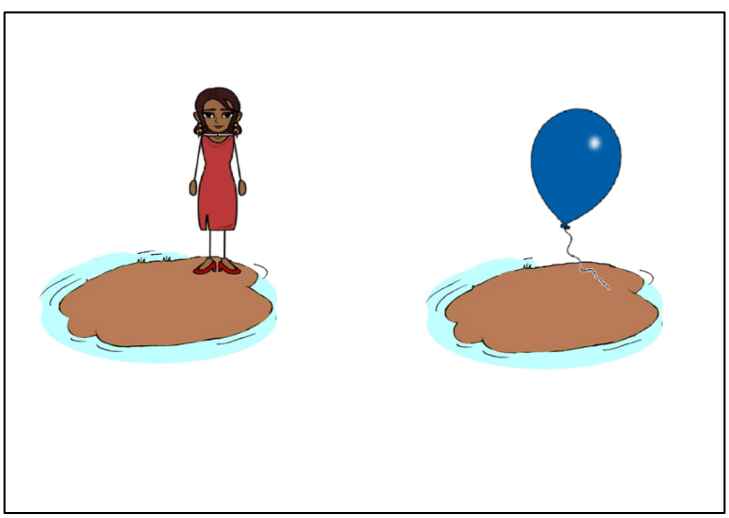

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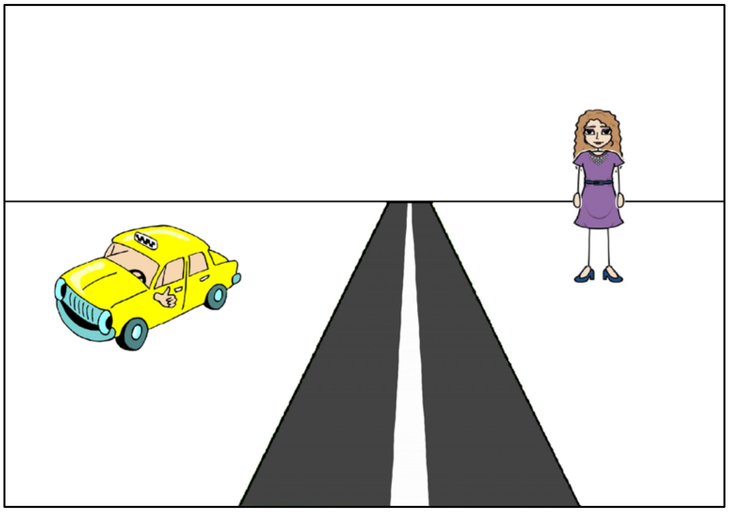

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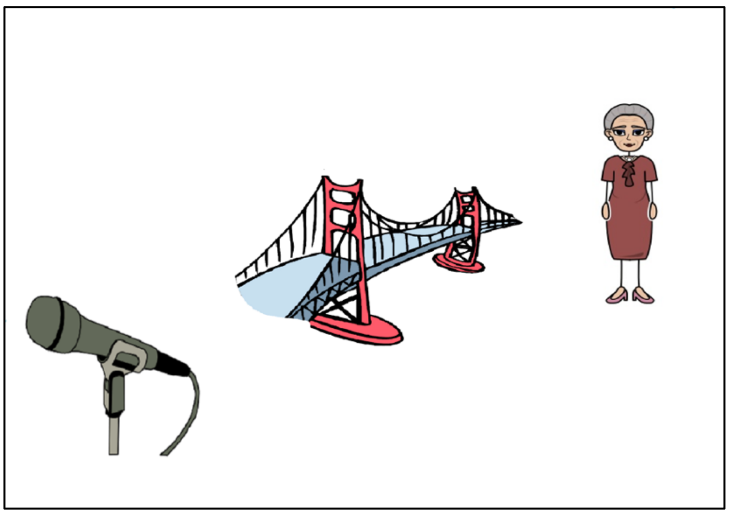

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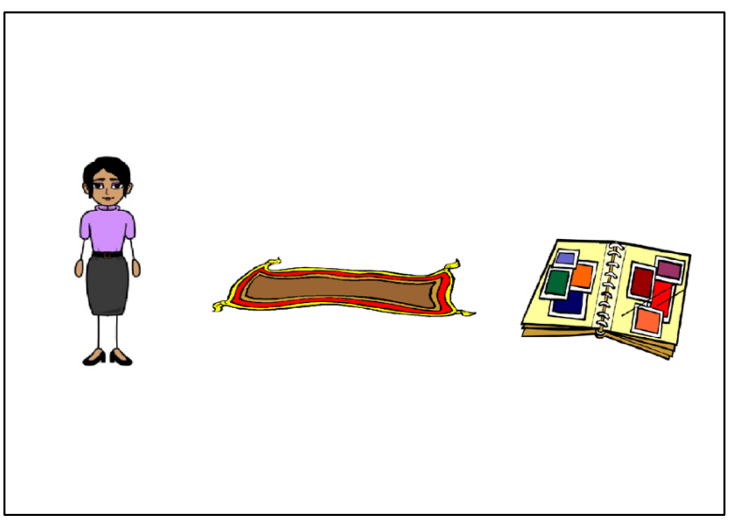

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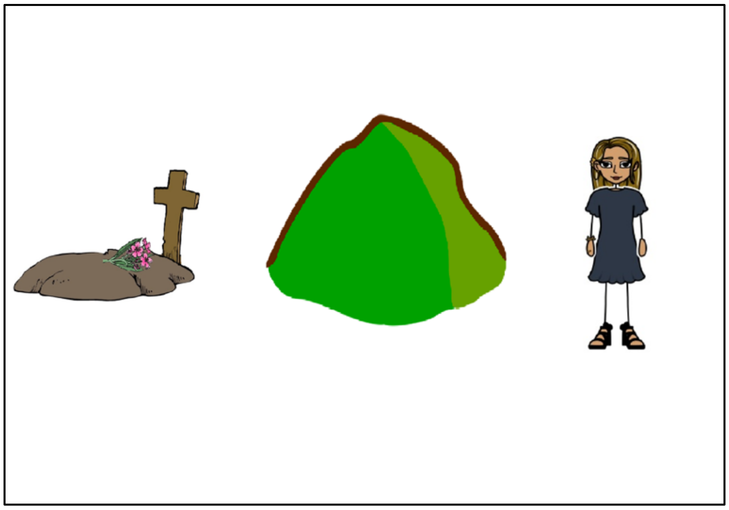

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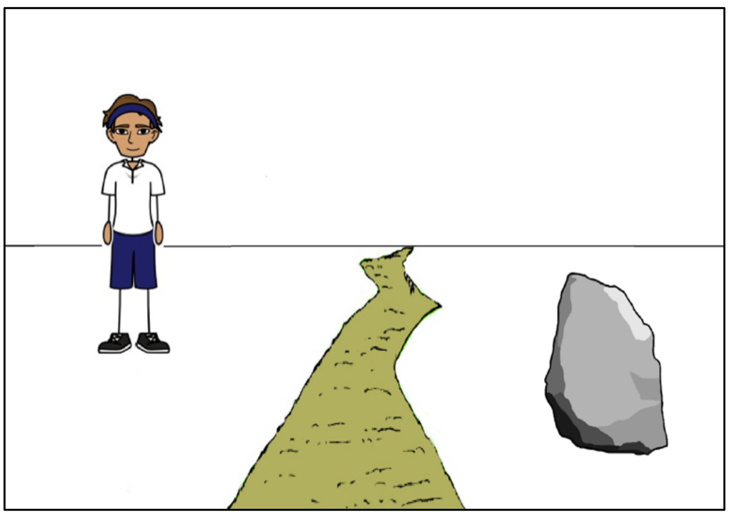

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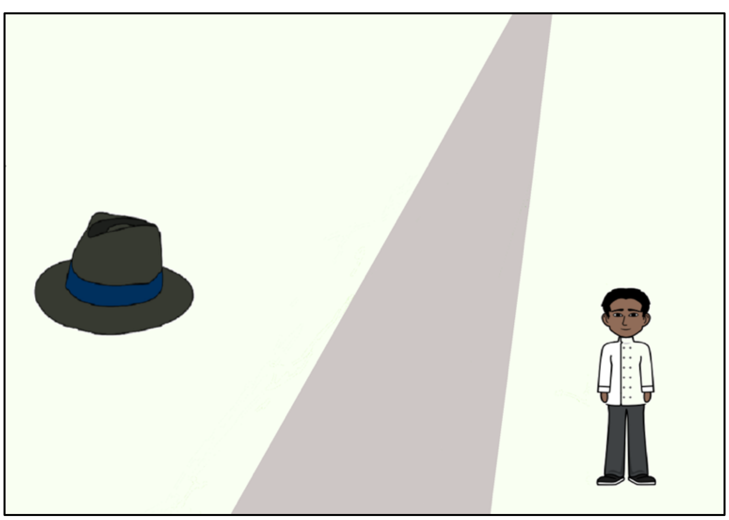

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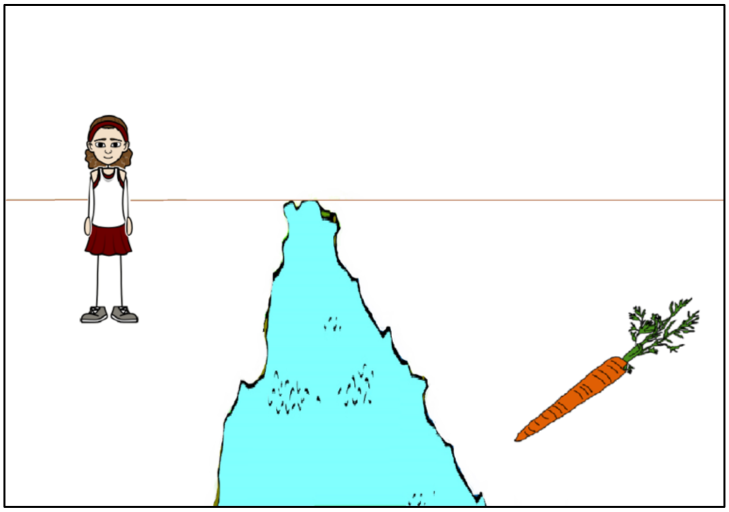
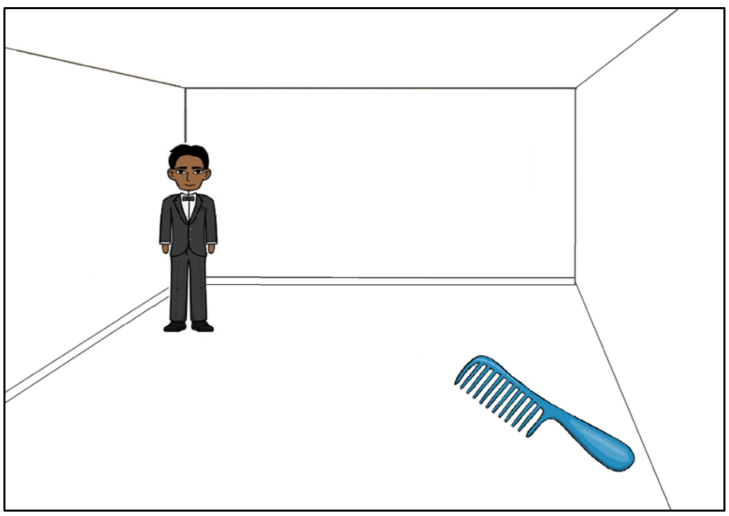
51. 

52. 

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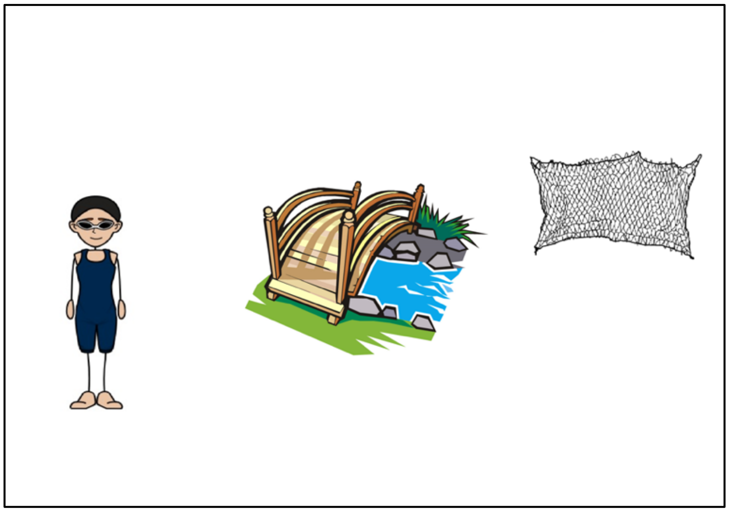

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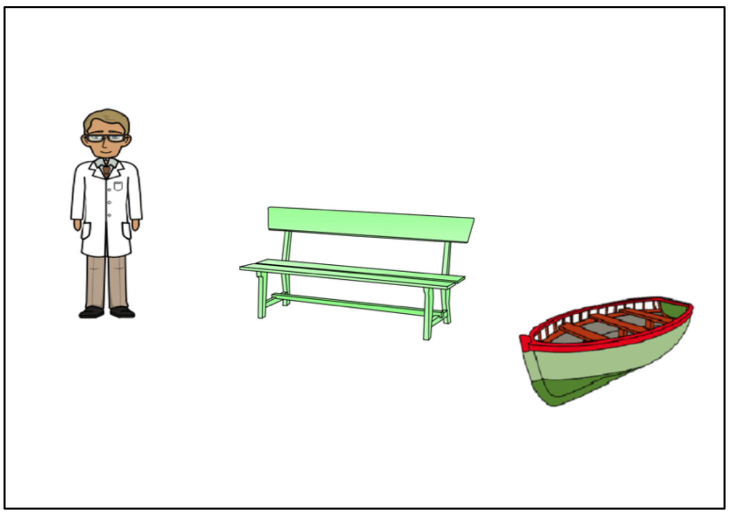

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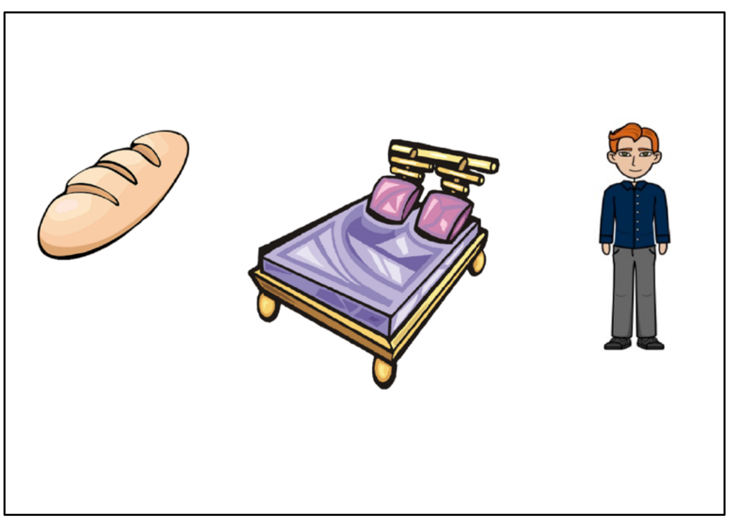

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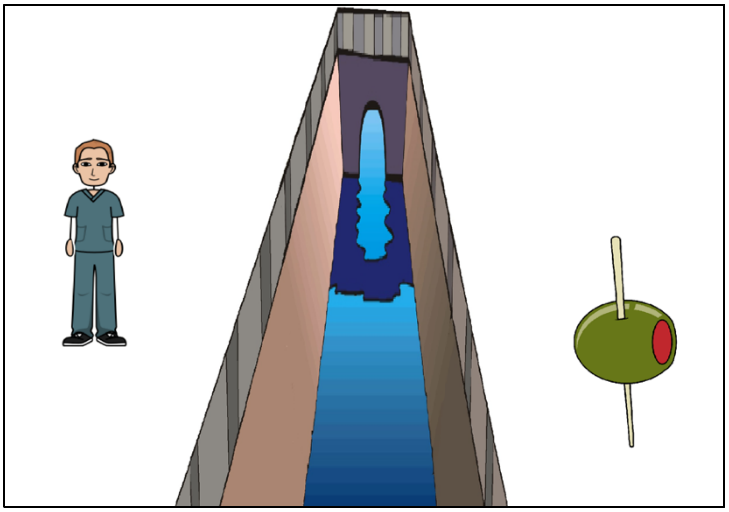

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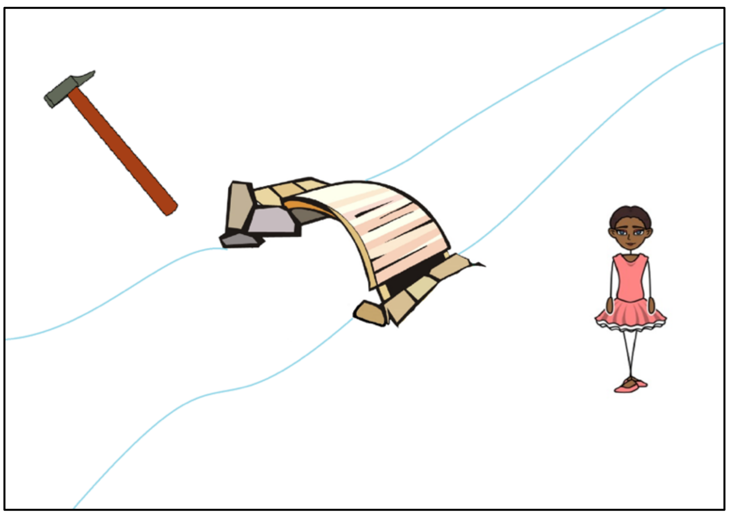

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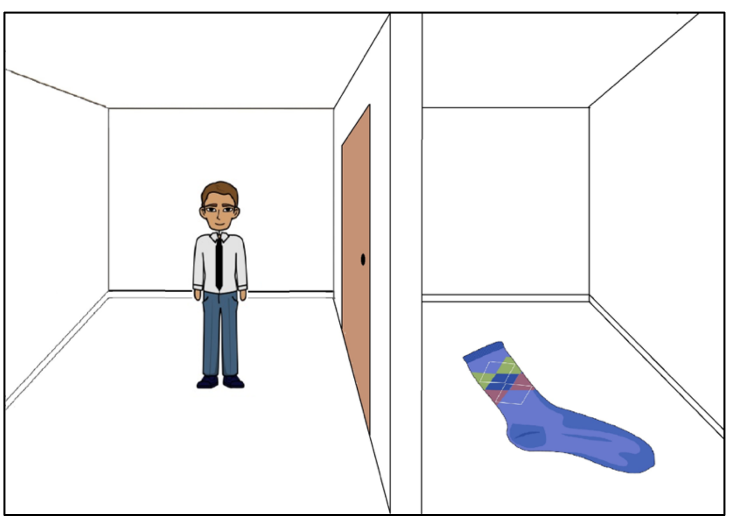

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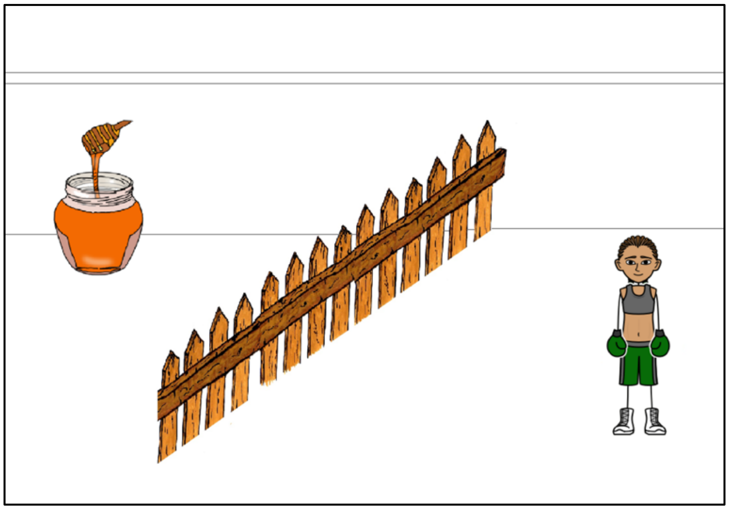
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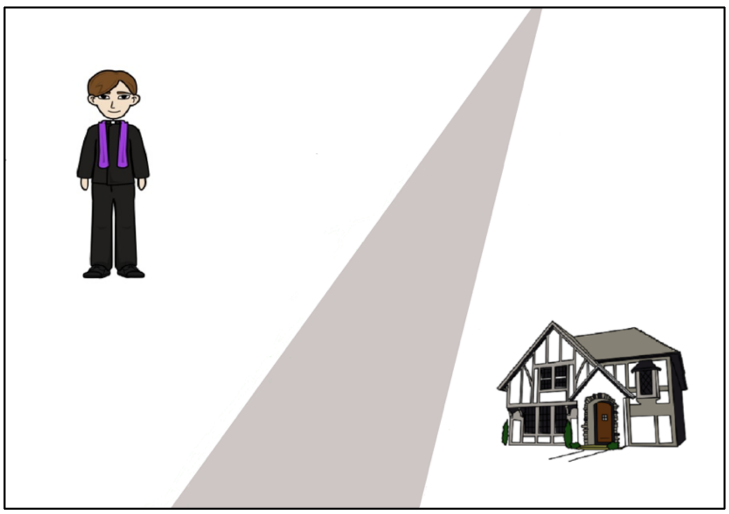
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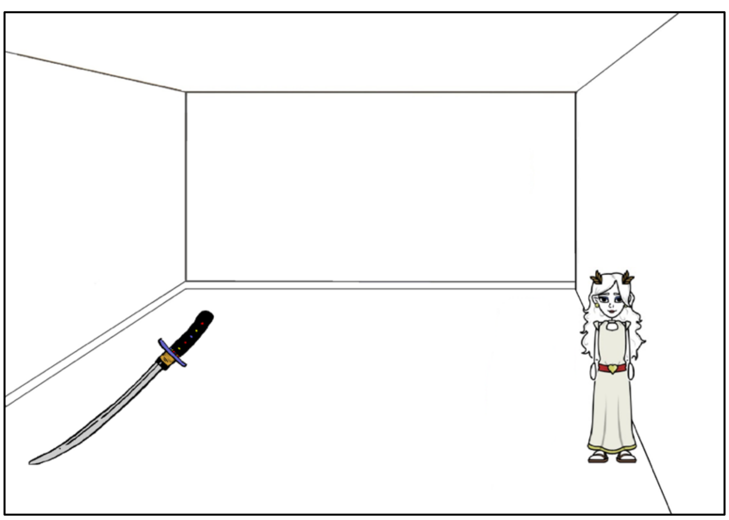
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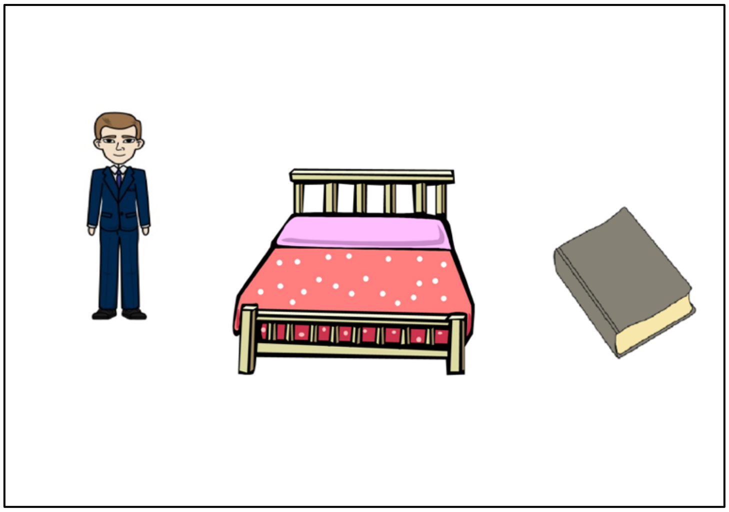
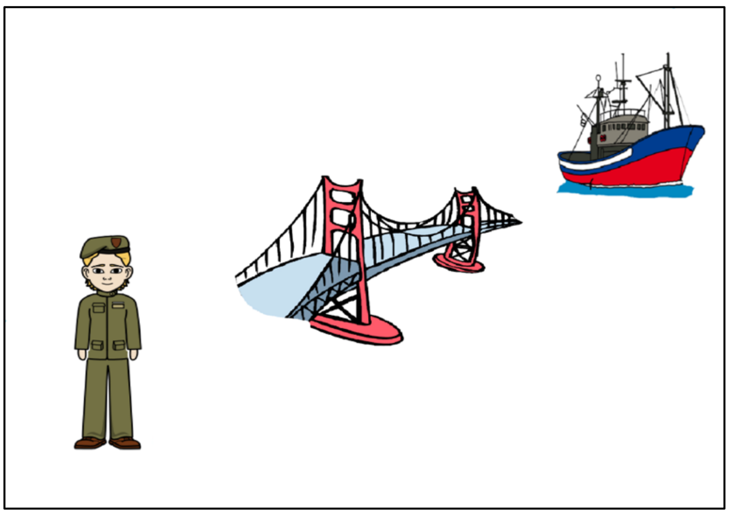


63.



64.

Experiment 2: L1 Spanish visual world sentences

LIST 1

Cognate match:

1. El chocolate será cortado por el atleta.

He is on the other side of the river.

The athlete may cross the river to reach the chocolate.

2. El violín será recogido por el camarero.

He is in the other room.

The waiter must open the door to get to the violin.

3. El café será picado por el chef.

He is across the field.

The chef has to get to the other field to reach the coffee.

4. La patata será pelada por la médica.

She is across the table.

The doctor needs to go to the other end of the table to grab the potato.

5. La ambulancia será pateada por la esquiadora.

She is across the road.

The skier needs to cross the road to reach the ambulance.

6. El tractor será robado por el ladrón.

He is in the other field.

The thief has to cross the road to get to the tractor.

7. La pizza será comida por la enfermera.

She is across the canal.

The nurse should cross the canal to reach the pizza.

8. El teléfono será agarrado por el boxeador.

He is in the other area.

The boxer needs to jump the fence to reach the telephone.

Cognate mismatch:

9. El taxi será subido por la nadadora.

She is in the other field.

The swimmer has to cross the road to get to the taxi.

10. La cámara será encendida por el abuelo.

He is at the other end of the room.

The grandpa should walk to the camera to turn it on.

11. El limón será cogido por la científica.

She is across the path.

The scientist should cross the path to take the lemon.

12. El vino será probado por la novia.

She is on the other side of the bed.

The bride needs to go to the other side of the bed to take the wine.

13. El tomate será plantado por la bailarina.

She is on the other side of the bridge.

The ballerina may cross the bridge to reach the tomato.

14. La bicicleta será conducida por el soldado.

He is on the other island.

The soldier might swim to the other island to reach the bicycle.

15. El tren será limpiado por la mecánica.

She is on the other side of the fence.

The mechanic ought to jump the fence to reach the train.

16. La rosa será observada por el profesor.

He is on the other side of the wall.

The teacher can go around the wall to look at the rose.

Noncognate match:

17. El espejo será limpiado por el cura.

He is on the other side of the fence.

The priest ought to go around the fence to take the mirror.

18. El pepino será comido por el granjero.

He is at the other end of the room.

The farmer needs to cross the room to get to the cucumber.

19. El libro será escrito por el animador.

He is across the fence.

The cheerleader has to cross the fence to reach the book.

20. La silla será pintada por la azafata.

She is across the fence.

The stewardess has to cross the fence to take the chair.

21. La cebolla será arrancada por la mujer.

She is in the other room.

The woman should go to the other room to reach the onion.

22. El barco será vendido por el piloto.

He is in the other field.

The pilot must cross the field to get to the ship.

23. La cuchara será devuelta por la sirvienta.

She is in the other room.

The maid has to open the door to reach the spoon.

24. El cuchillo será pulido por el graduado.

He is across the pond.

The graduate should walk around the pond to get to the knife.

Noncognate mismatch:

25. La plancha será encontrada por el padre.

He is on the other side of the bed.

The father may walk to the other side of the bed to get the iron.

26. El lápiz será comprado por la mujer.

She is on the other island.

The woman should swim to the other island to reach the pencil.

27. El reloj será admirado por la pilota.

She is on the other end of the hill.

The pilot needs to walk over the hill to see the watch.

28. La manzana será lavada por el policía.

He is at the other end of the table.

The police officer should get to the other end of the table to take the apple.

29. La zanahoria será olida por el gimnasta.

He is in the other corner.

The gymnast has to cross the room to get to the carrot.

30. El tenedor será doblado por la esposa.

She is across the path.

The wife needs to cross the path to reach the fork.

31. El armario será movido por la abogada.

She is on the other side of the river.

The attorney ought to swim to the other side of the river to get to the wardrobe.

32. El vaso será vaciado por la secretaria.

She is across the pond.

The secretary should walk around the pond to get to the glass.

LIST 2

Cognate match:

1. El taxi será subido por el turista.

He is in the other field.

The tourist has to cross the road to get to the taxi.

2. La cámara será encendida por la abuela.

She is at the other end of the room.

The grandma should walk to the camera to turn it on.

3. El limón será cogido por el científico.

He is across the path.

The scientist should cross the path to take the lemon.

4. El vino será probado por el novio.

He is on the other side of the bed.

The groom needs to go to the other side of the bed to take the wine.

5. El tomate será plantado por el hippie.

He is on the other side of the bridge.

The hippie may cross the bridge to reach the tomato.

6. La bicicleta será conducida por la soldada.

She is on the other island.

The soldier might swim to the other island to reach the bicycle.

7. El tren será limpiado por el mecánico.

He is on the other side of the fence.

The mechanic ought to jump the fence to reach the train.

8. La rosa será observada por la profesora.

She is on the other side of the wall.

The teacher can go around the wall to look at the rose.

Cognate mismatch:

9. El chocolate será cortado por la atleta.

She is on the other side of the river.

The athlete may cross the river to reach the chocolate.

10. El violín será recogido por la camarera.

She is in the other room.

The waiter must open the door to get to the violin.

11. El café será picado por la chef.

She is across the field.

The chef has to get to the other field to reach the coffee.

12. La patata será pelada por el médico.

He is across the table.

The doctor needs to go to the other end of the table to grab the potato.

13. La ambulancia será pateada por el esquiador.

He is across the road.

The skier needs to cross the road to reach the ambulance.

14. El tractor será robado por la ladrona.

She is in the other field.

The thief has to cross the road to get to the tractor.

15. La pizza será comida por el enfermero.

He is across the canal.

The nurse should cross the canal to reach the pizza.

16. El teléfono será agarrado por la boxeadora.

She is in the other area.

The boxer needs to jump the fence to reach the telephone.

Noncognates match:

17. La plancha será encontrada por la madre.

She is on the other side of the bed.

The mother may walk to the other side of the bed to get the iron.

18. El lápiz será comprado por el hombre.

He is on the other island.

The man should swim to the other island to reach the pencil.

19. El reloj será admirado por el pilota.

He is on the other end of the hill.

The pilot needs to walk over the hill to see the watch.

20. La manzana será lavada por la policía.

She is at the other end of the table.

The police officer should get to the other end of the table to take the apple.

21. La zanahoria será olida por la gimnasta.

She is in the other corner.

The gymnast has to cross the room to get to the carrot.

22. El tenedor será doblado por el marido.

He is across the path.

The husband needs to cross the path to reach the fork.

23. El armario será movido por el abogado.

He is on the other side of the river.

The attorney ought to swim to the other side of the river to get to the wardrobe.

24. El vaso será vaciado por el secretario.

He is across the pond.

The secretary should walk around the pond to get to the glass.

Noncognates mismatch:

25. El espejo será limpiado por la monja.

She is on the other side of the fence.

The nun ought to go around the fence to take the mirror.

26. El pepino será comido por la diosa.

She is at the other end of the room.

The goddess needs to cross the room to get to the cucumber.

27. El libro será escrito por la animadora.

She is across the fence.

The cheerleader has to cross the fence to reach the book.

28. La silla será pintada por el azafato.

He is across the fence.

The steward has to cross the fence to take the chair.

29. La cebolla será arrancada por el hombre.

He is in the other room.

The man should go to the other room to reach the onion.

30. El barco será vendido por la pilota.

She is in the other field.

The pilot must cross the field to get to the ship.

31. La cuchara será devuelta por el sirvienta.

He is in the other room.

The maid has to open the door to reach the spoon.

32. El cuchillo será pulido por la señora.

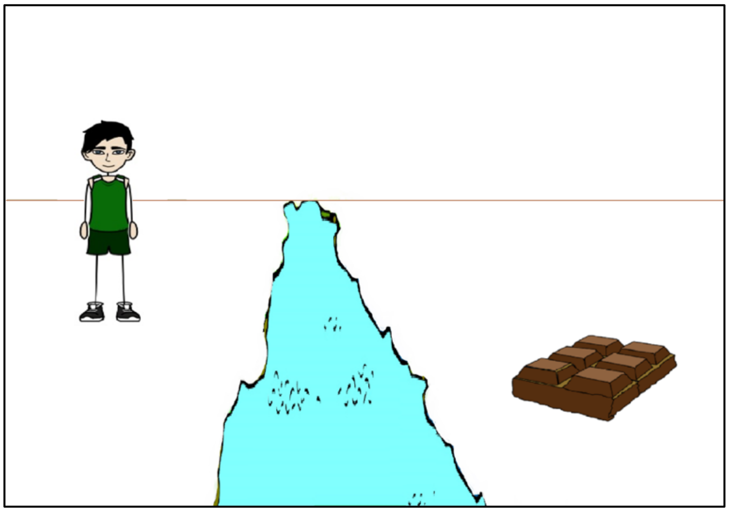
She is across the pond.

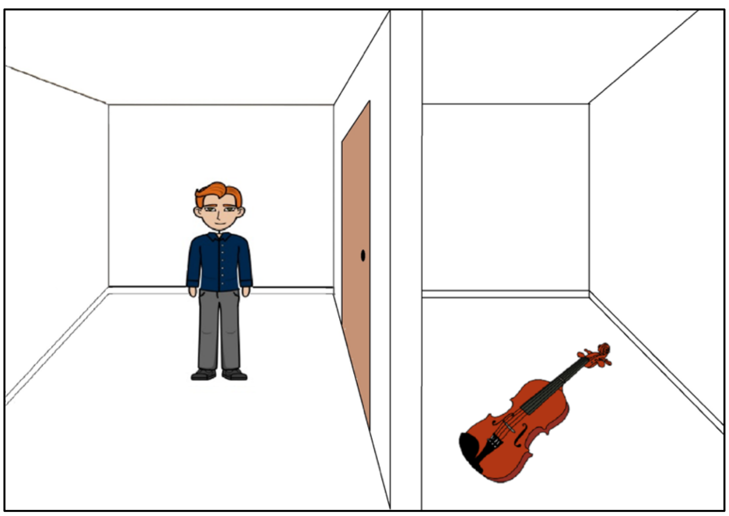
The lady should walk around the pond to get to the knife.

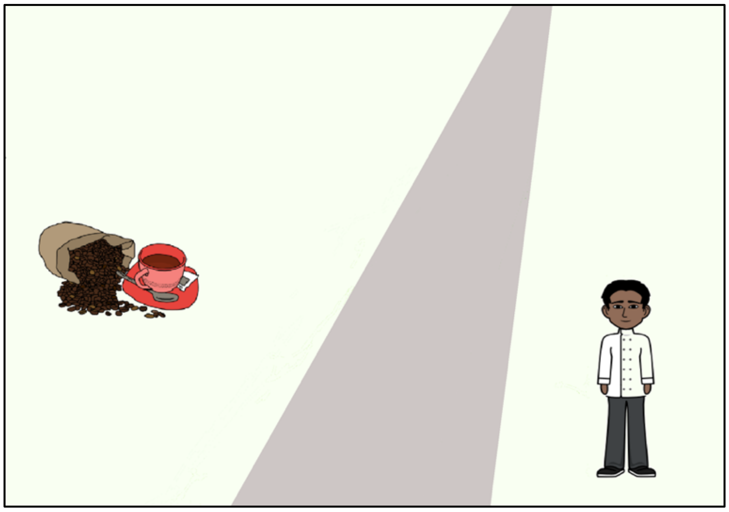
Experiment 2: L1 Spanish visual world pictures

LIST 1

Cognate match:

1. 

2. 



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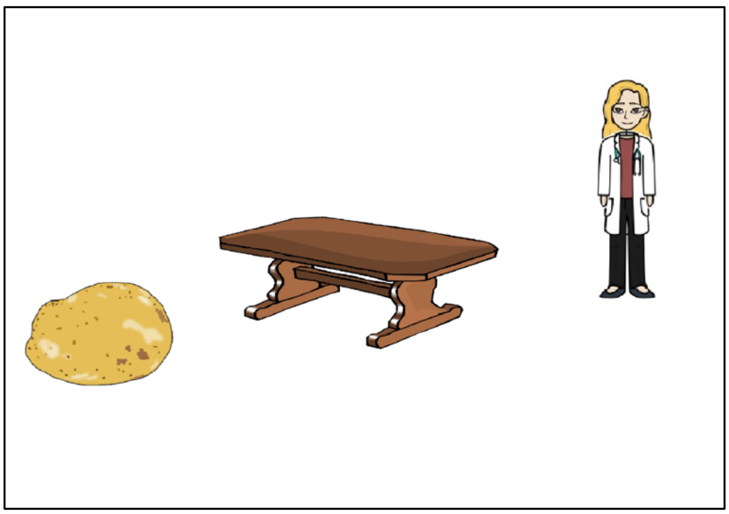

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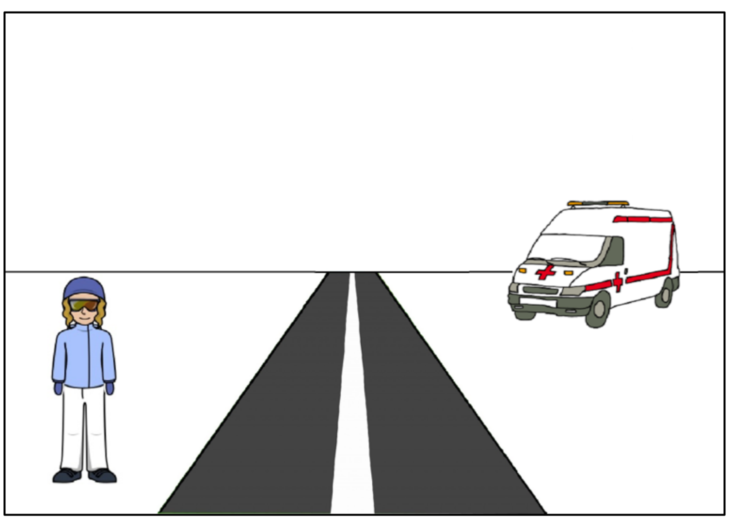

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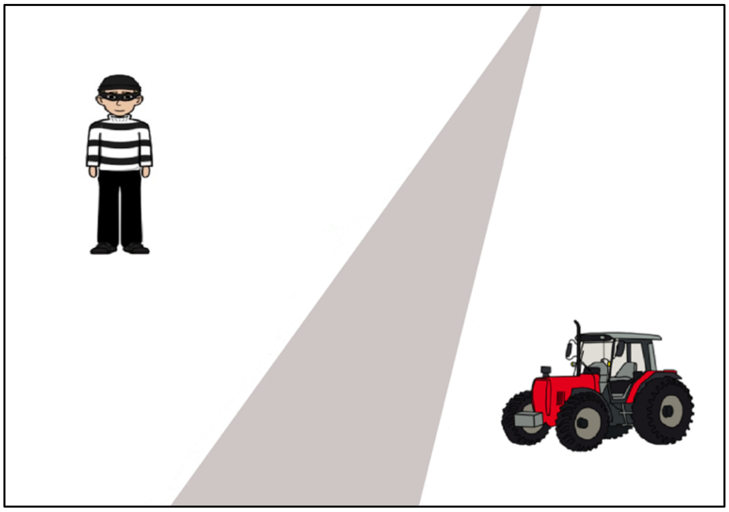

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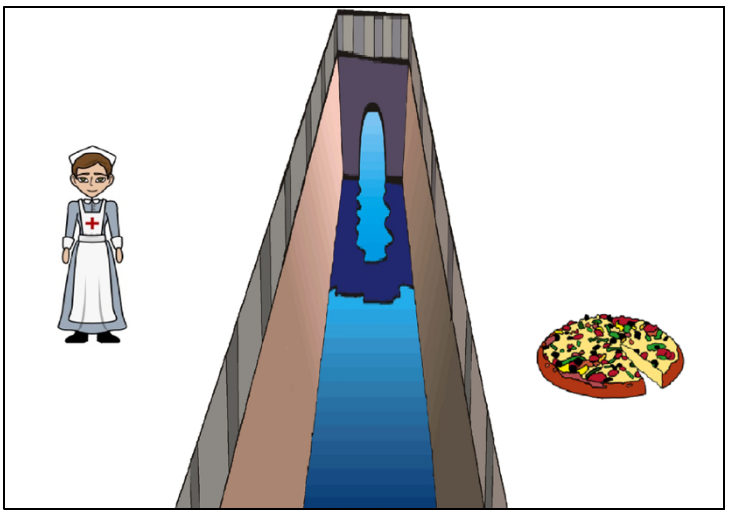

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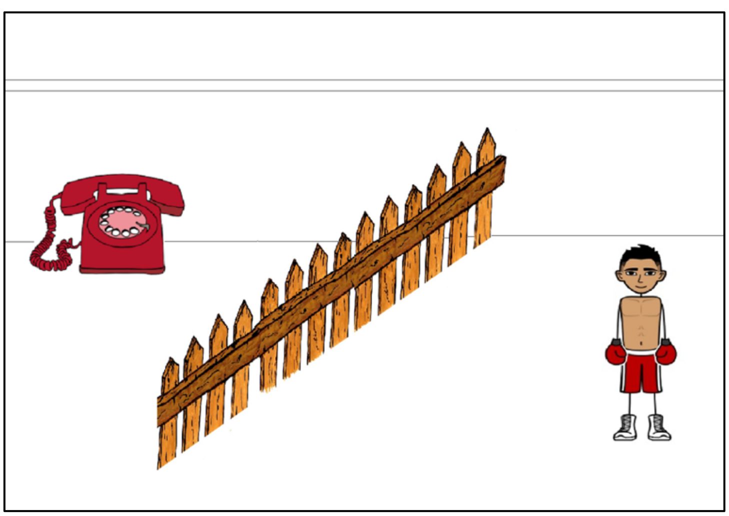

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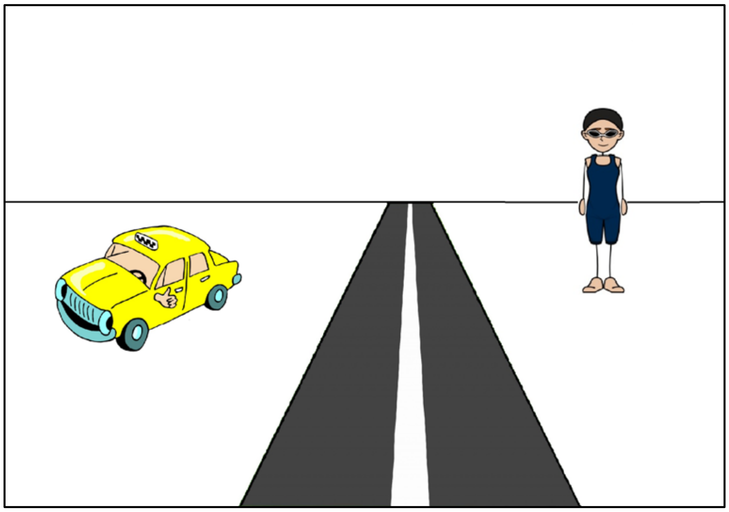

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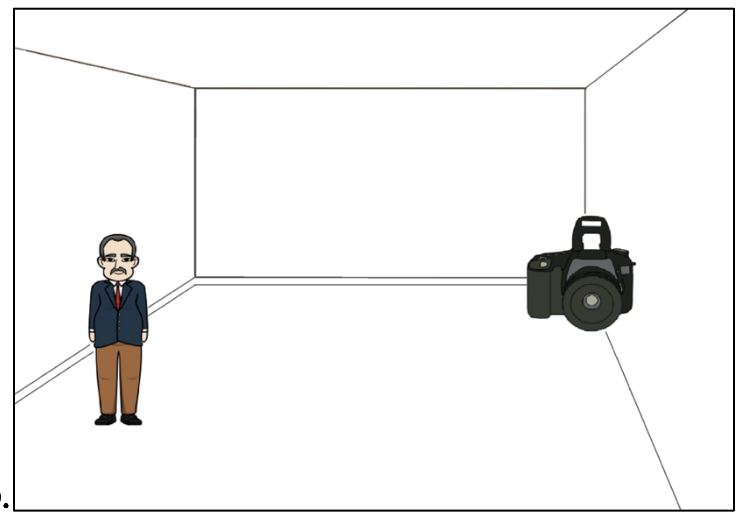

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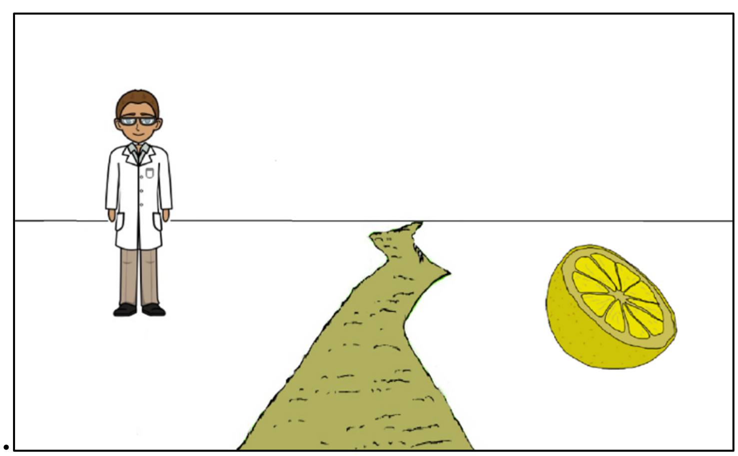

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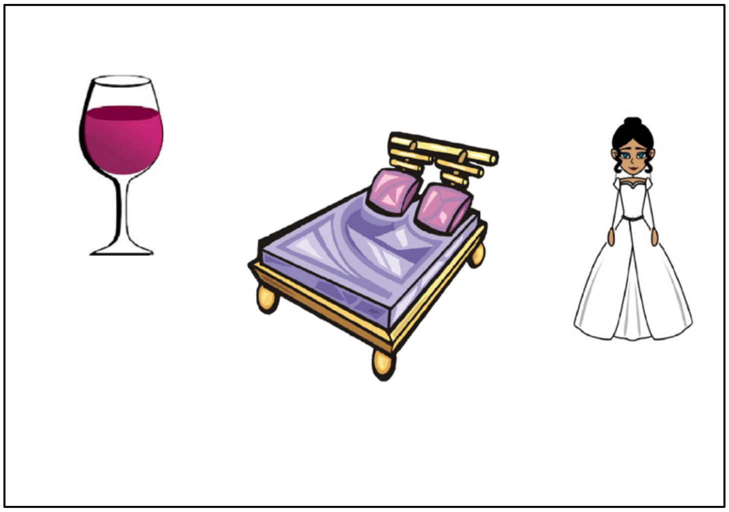

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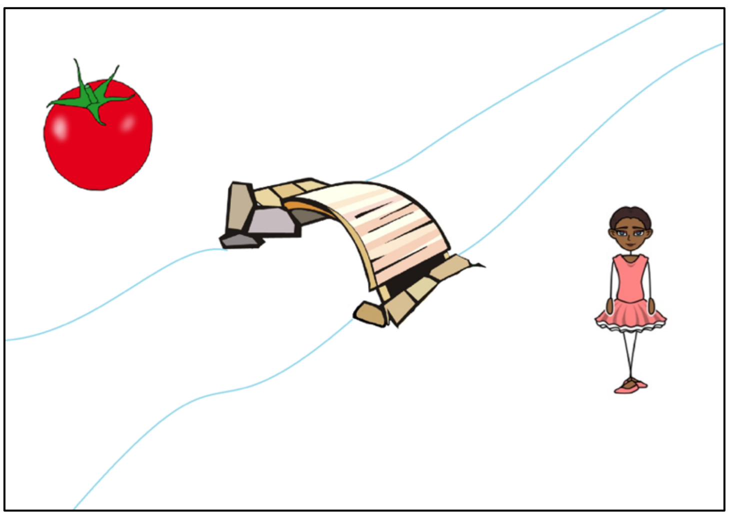

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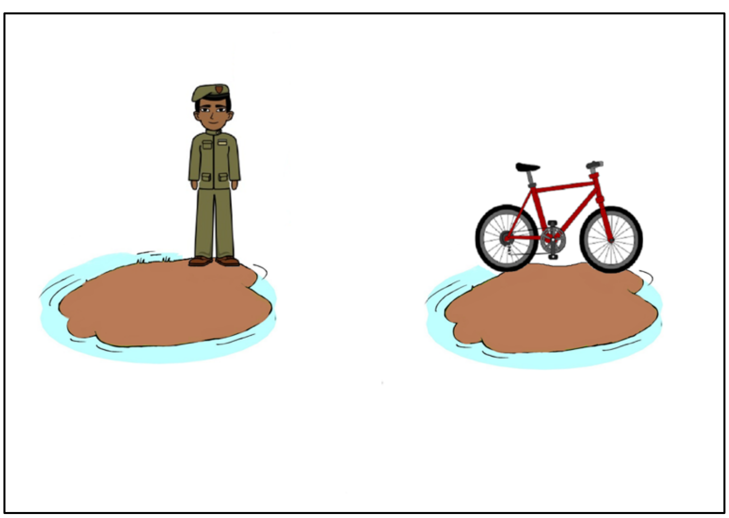

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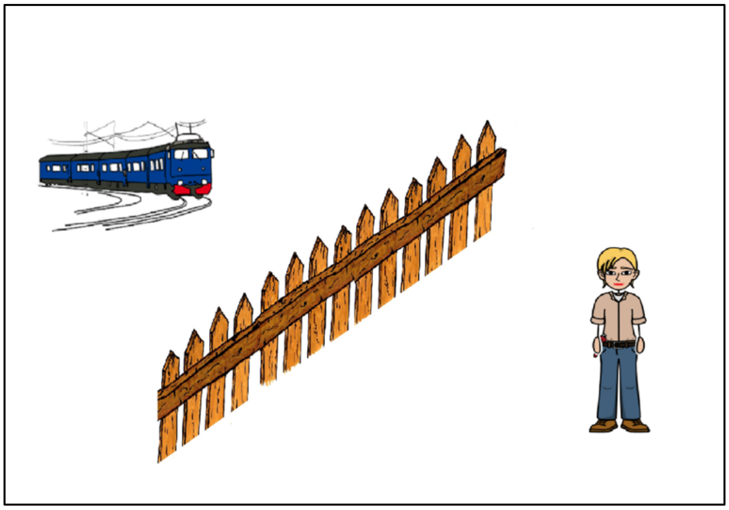

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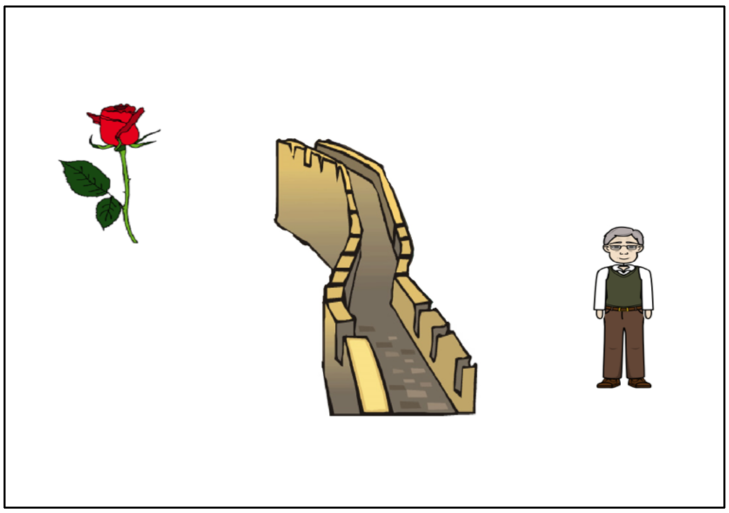

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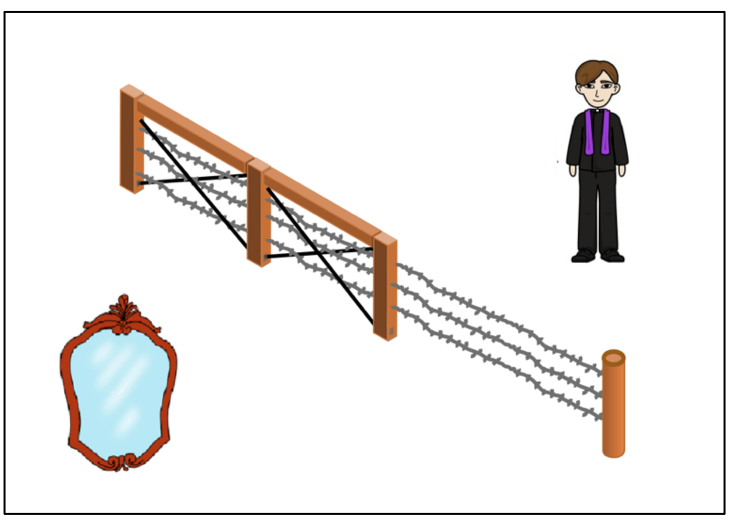

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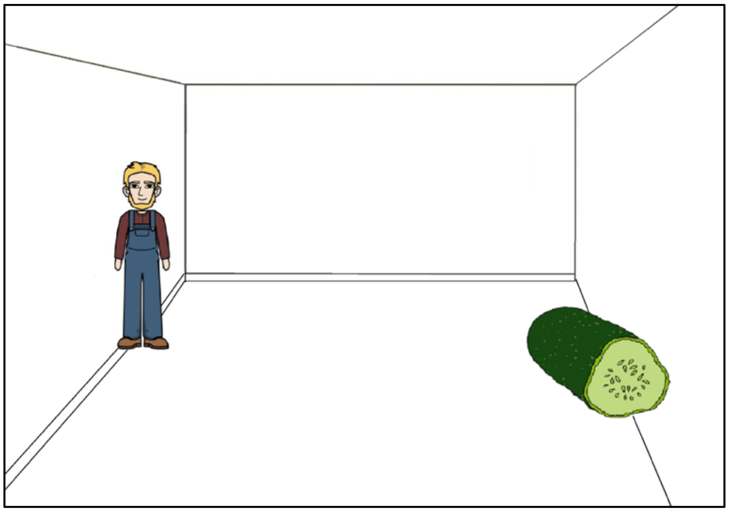

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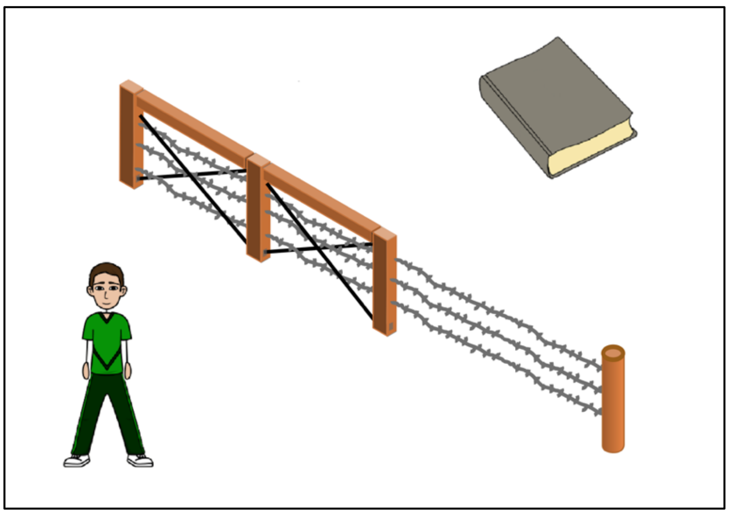

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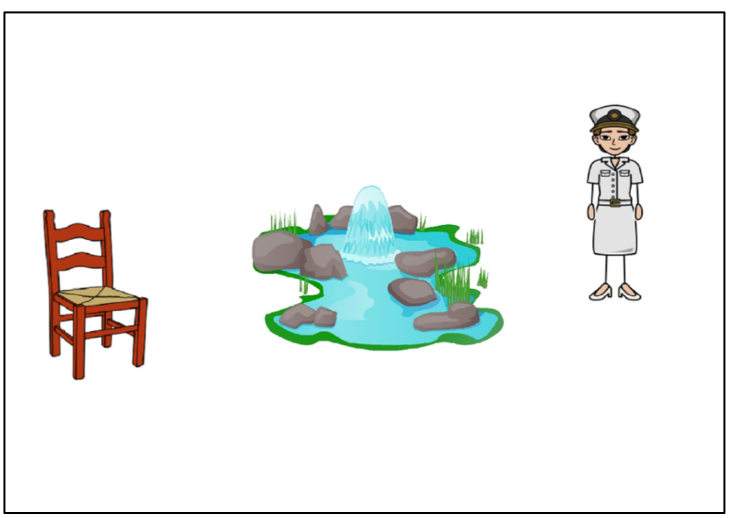

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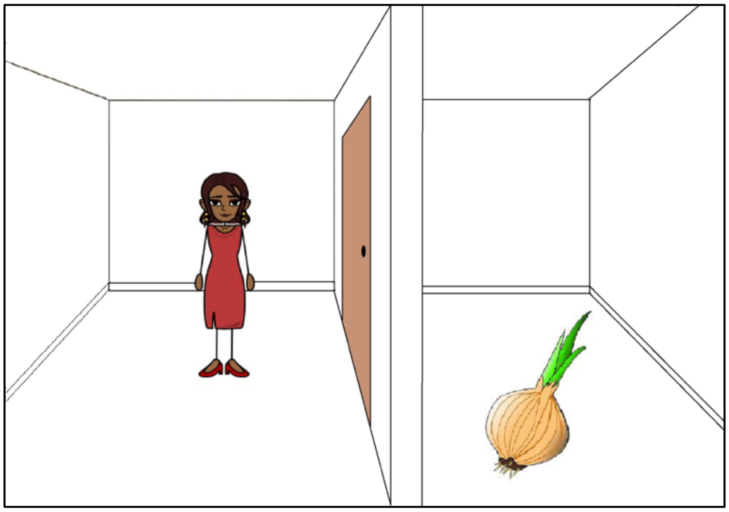

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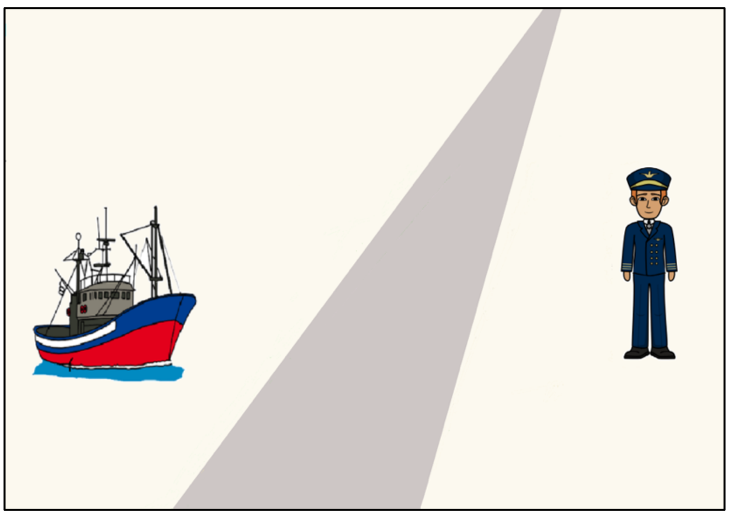

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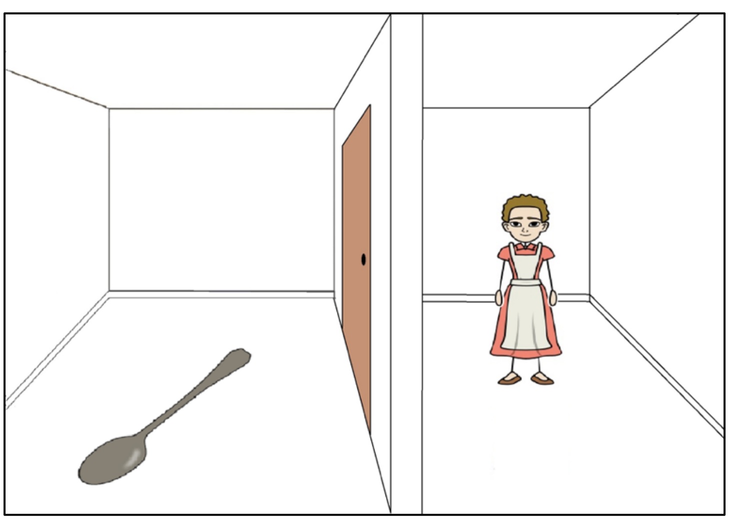

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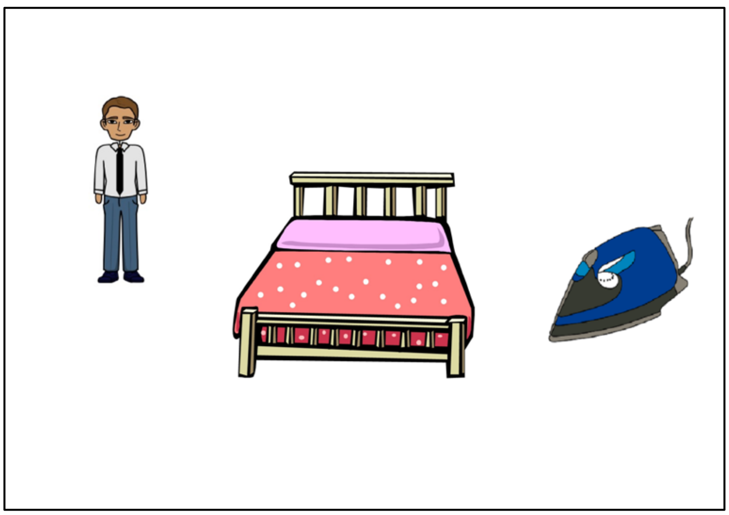

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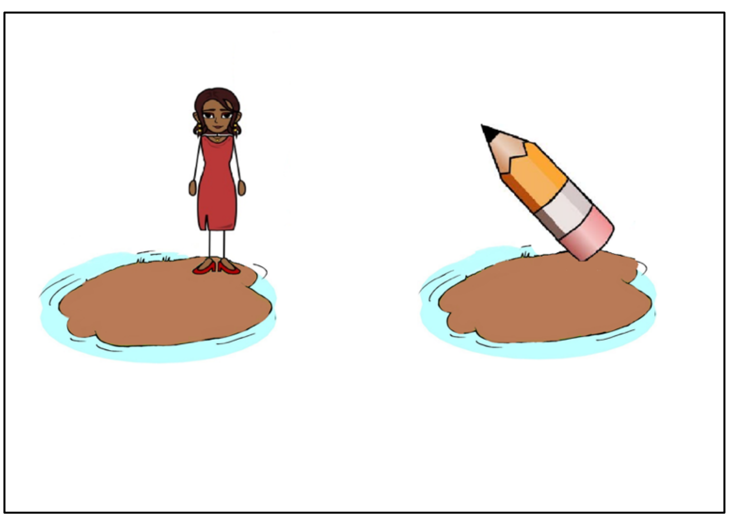

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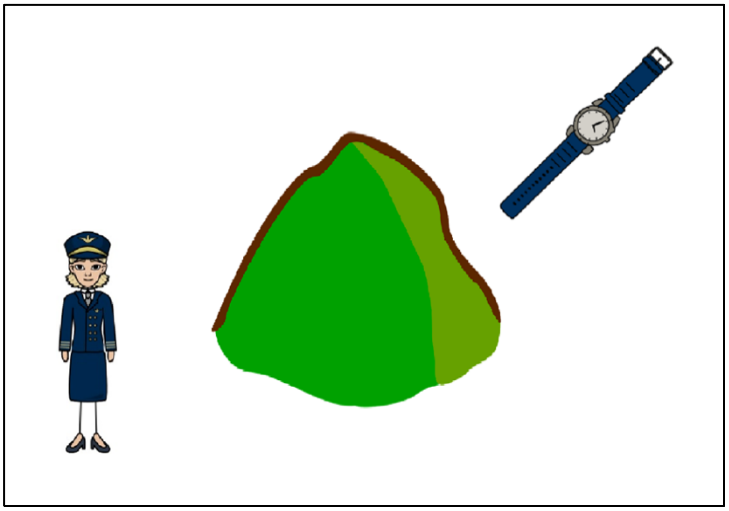

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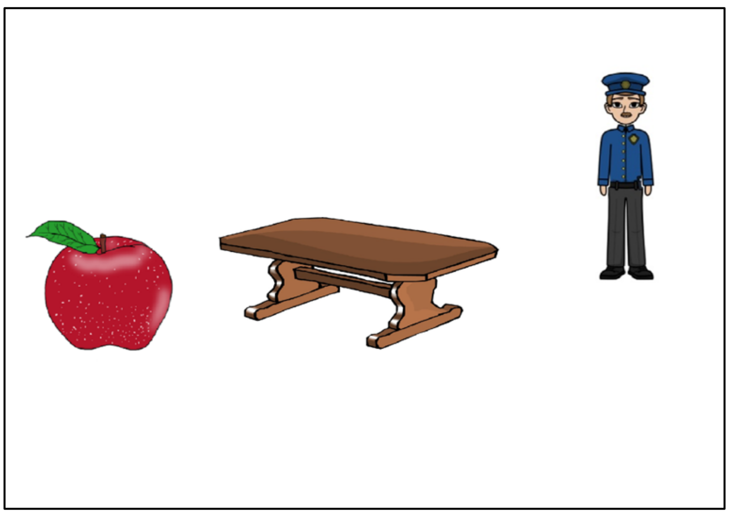

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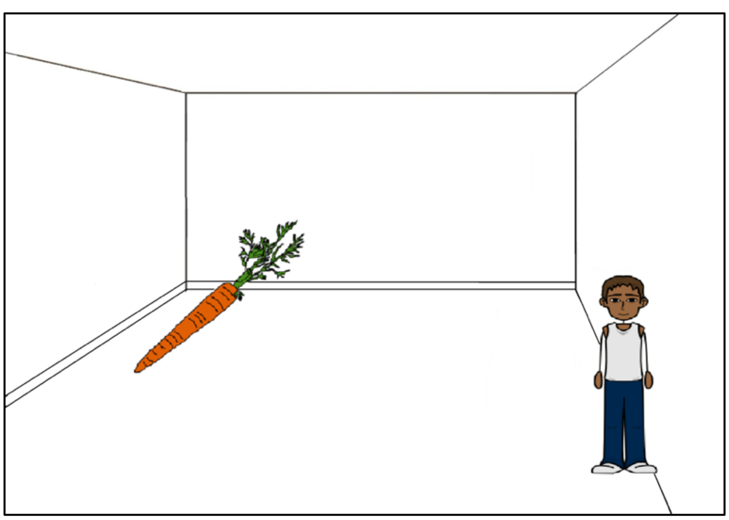

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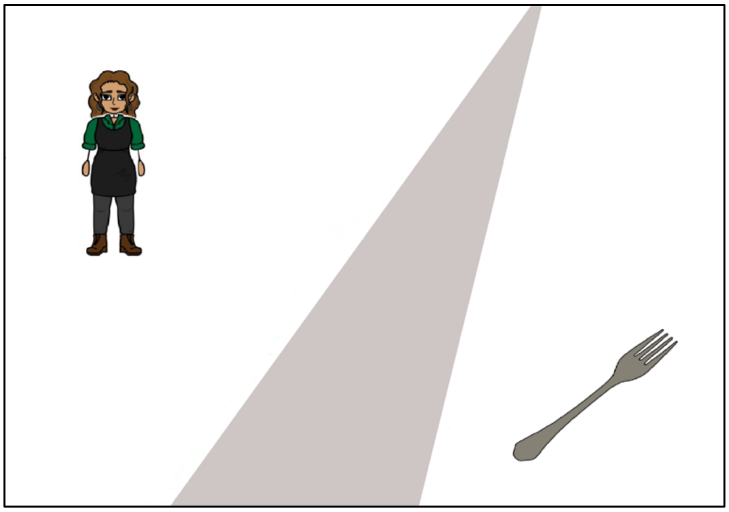

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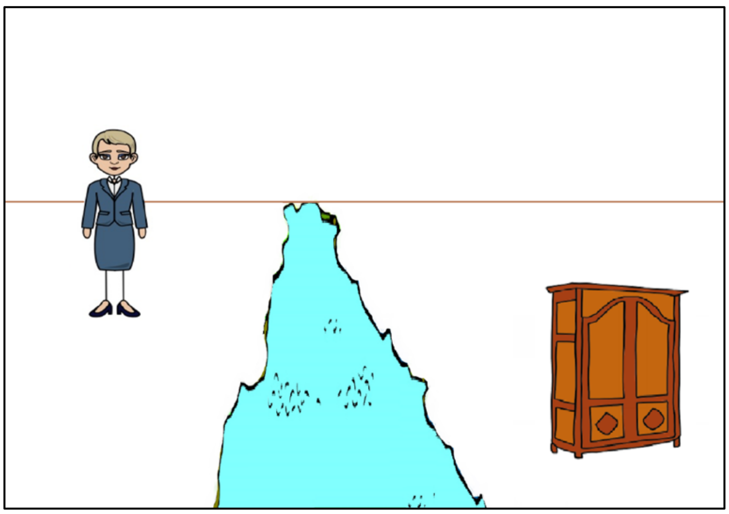

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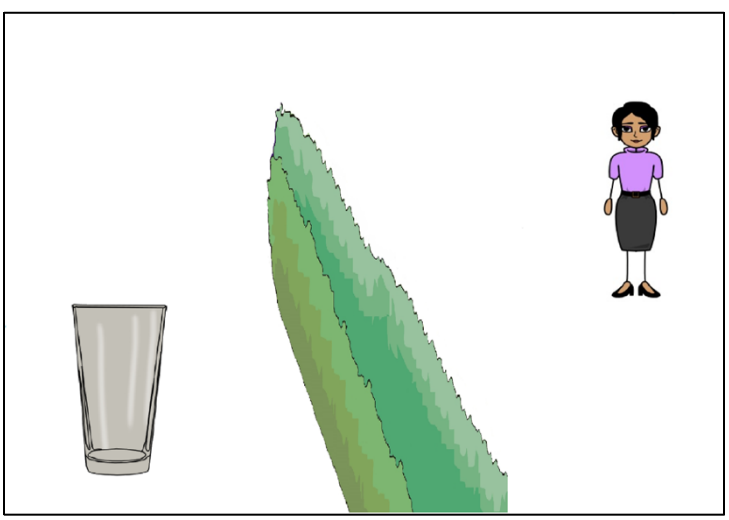

32.

LIST 2

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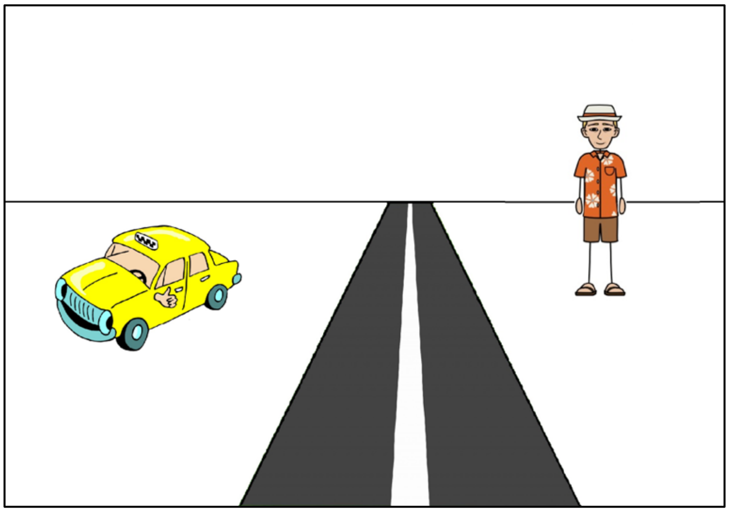

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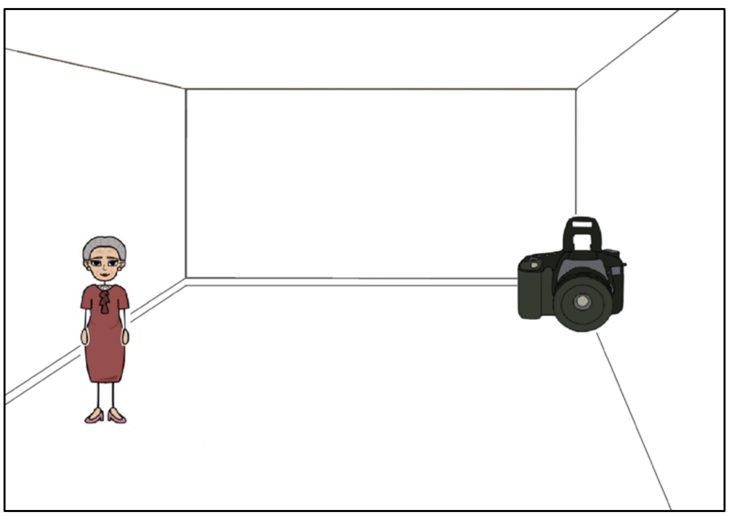

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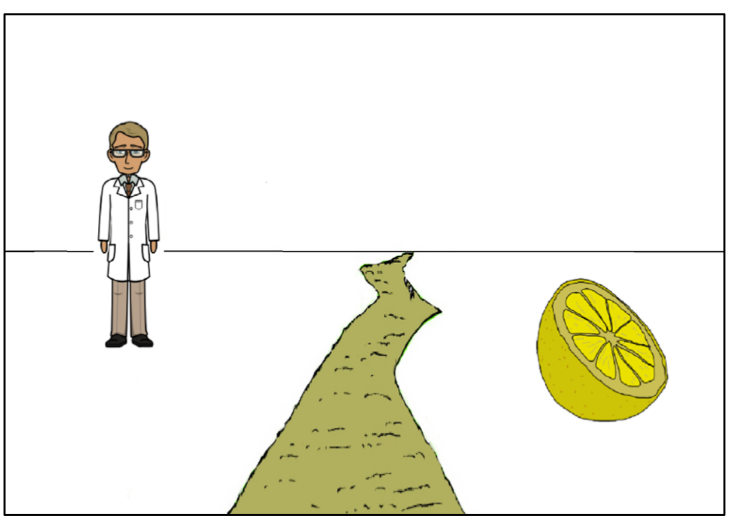

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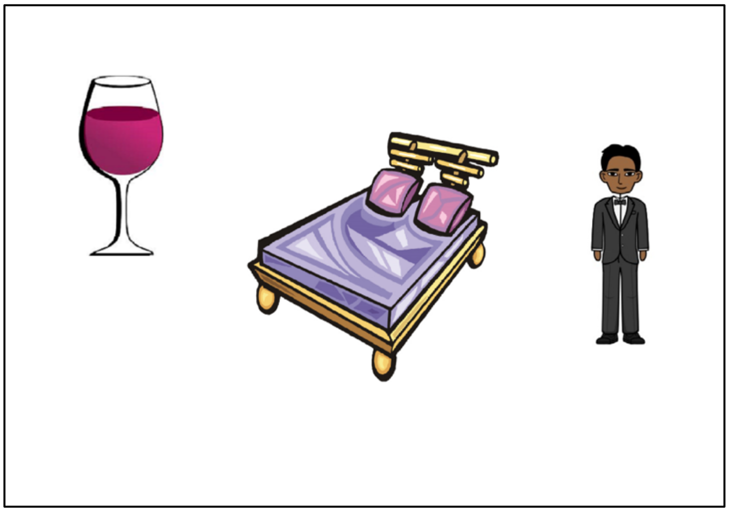

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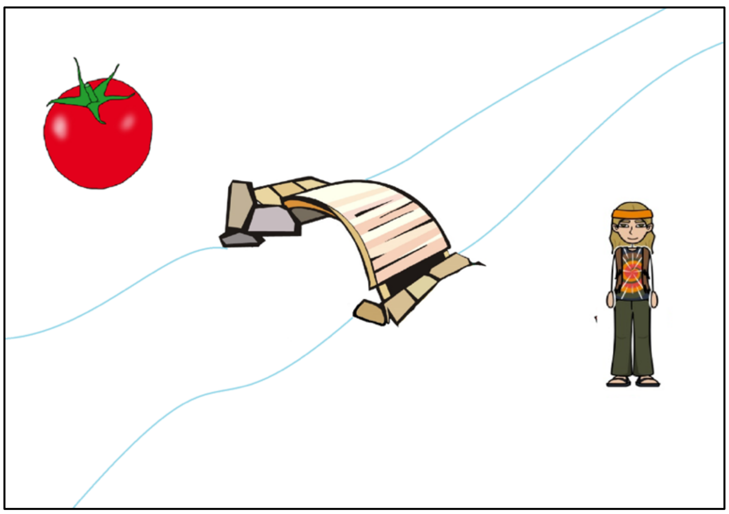

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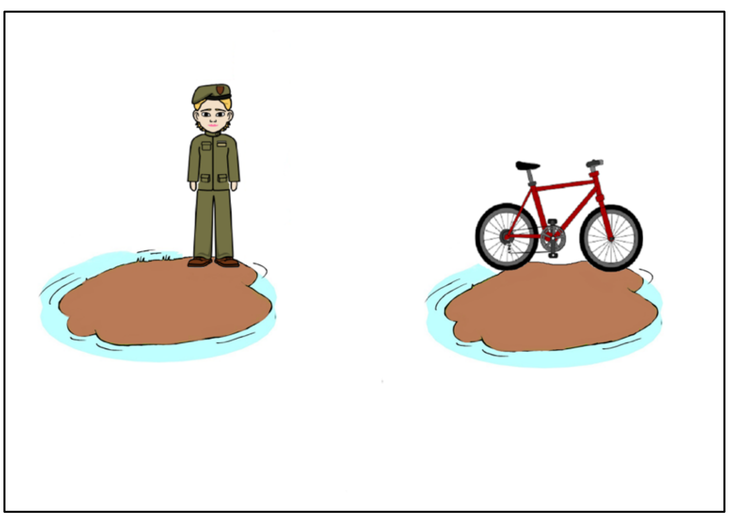

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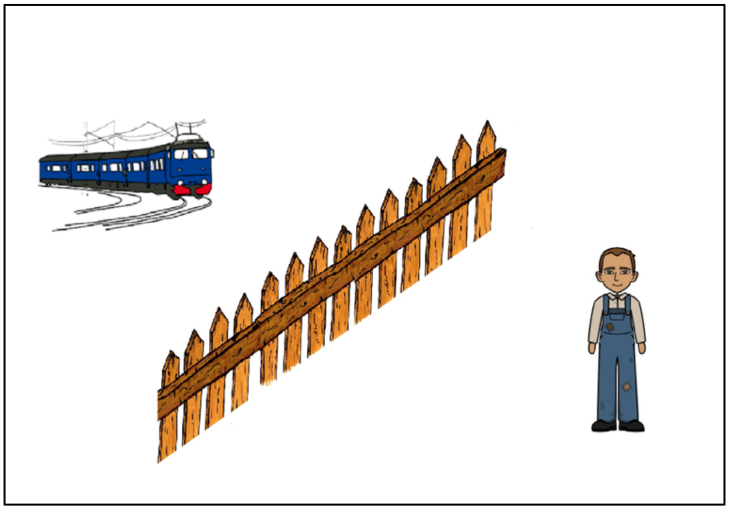

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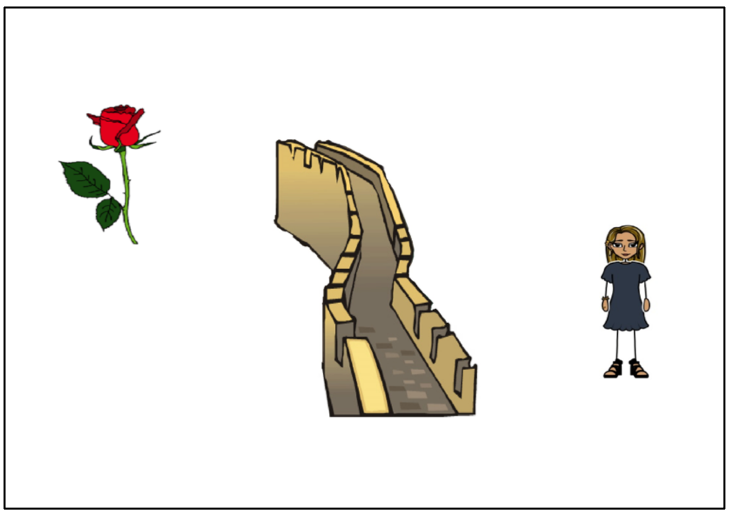

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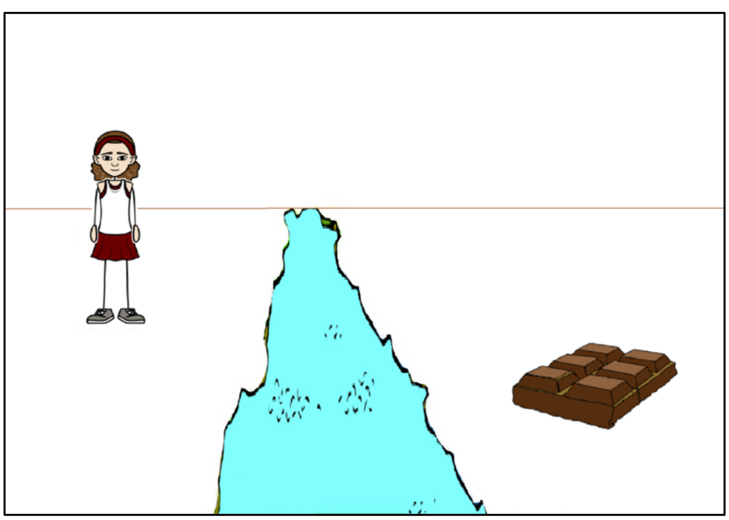

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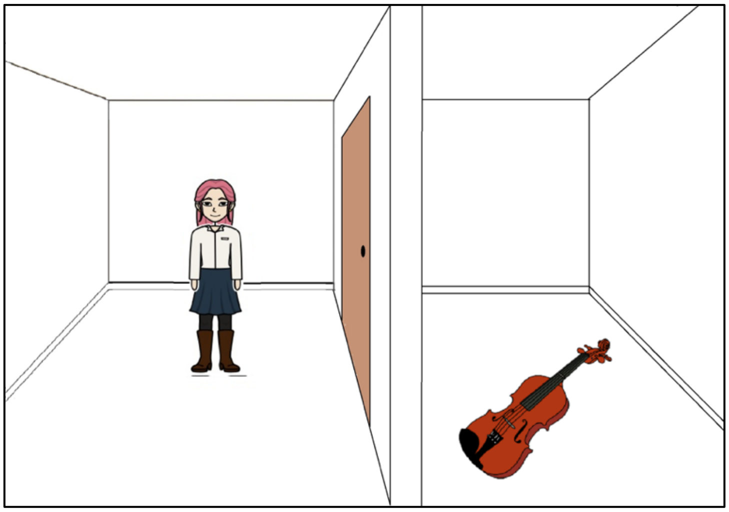

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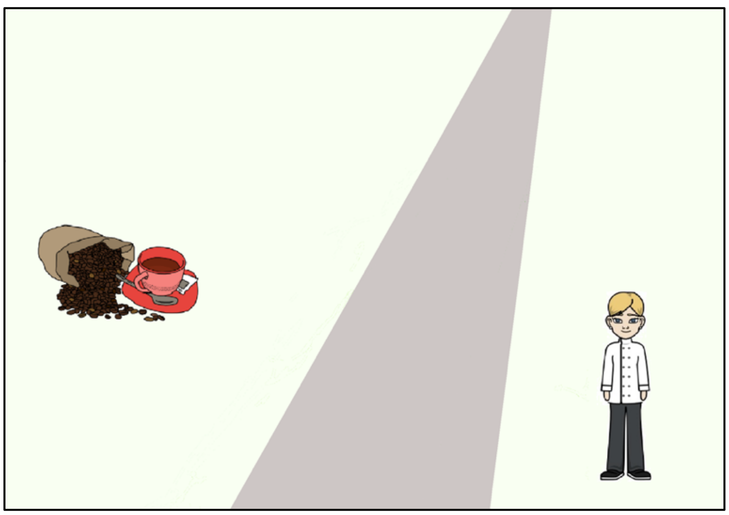

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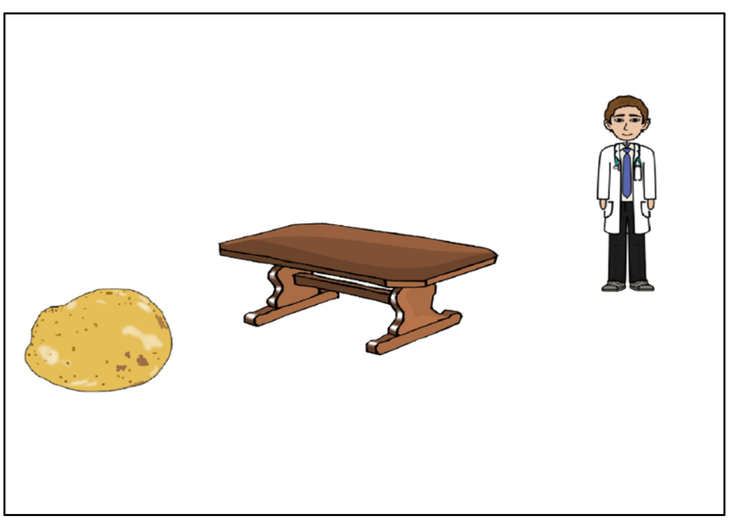

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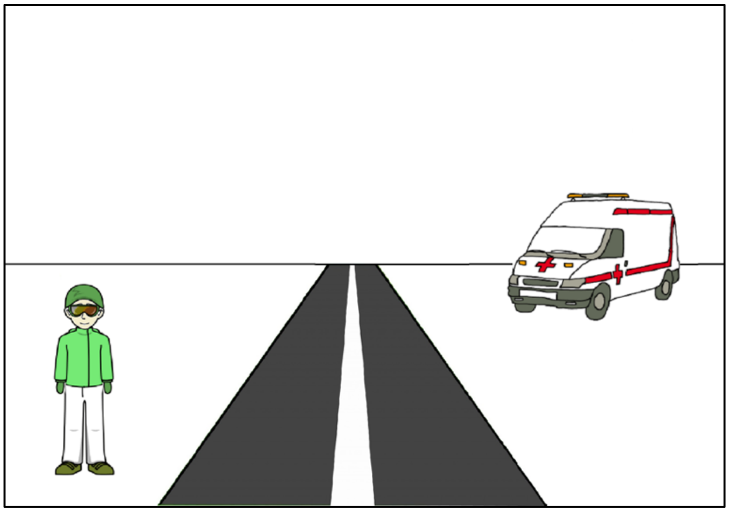

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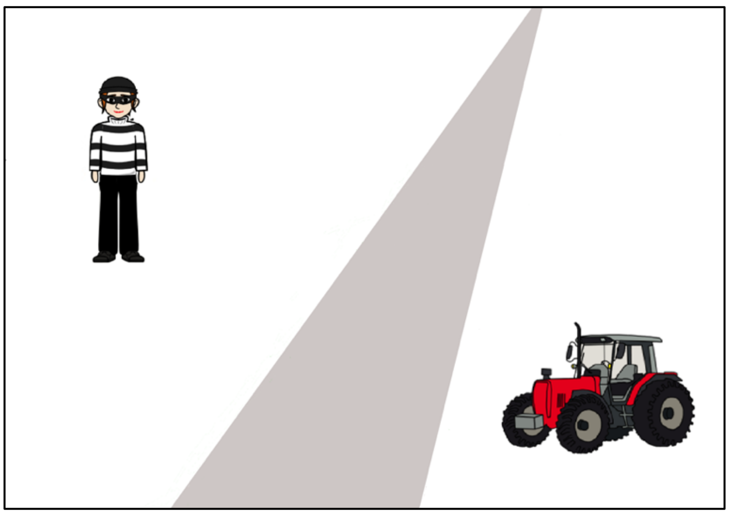

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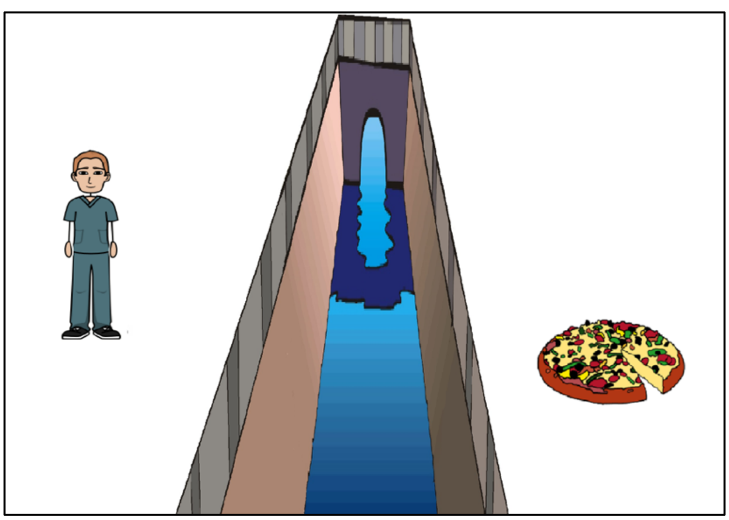

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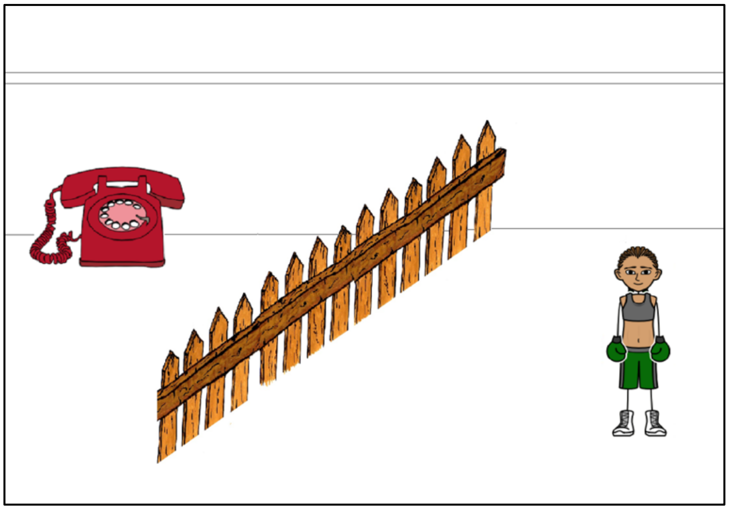
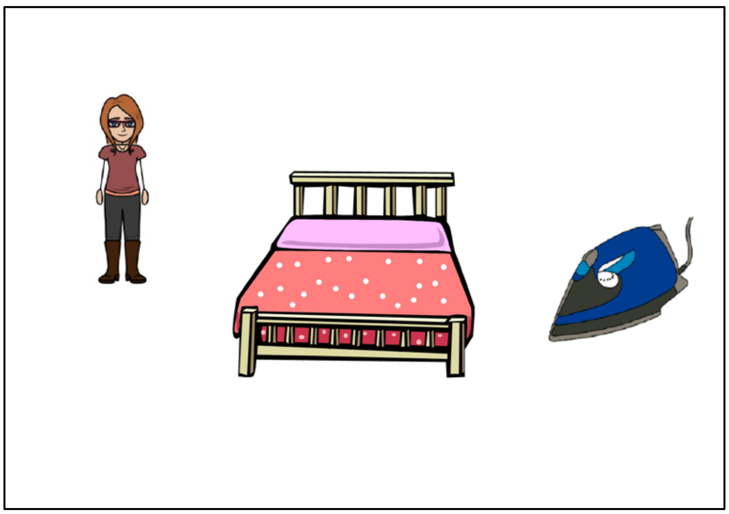


16.

Noncognate match:



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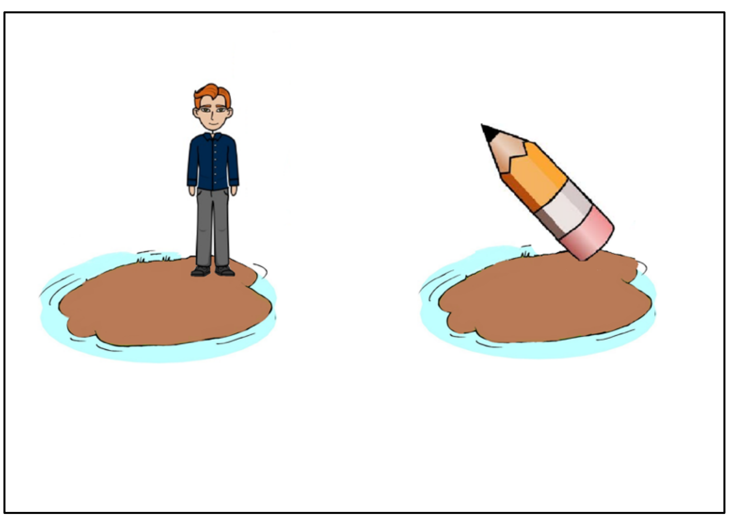
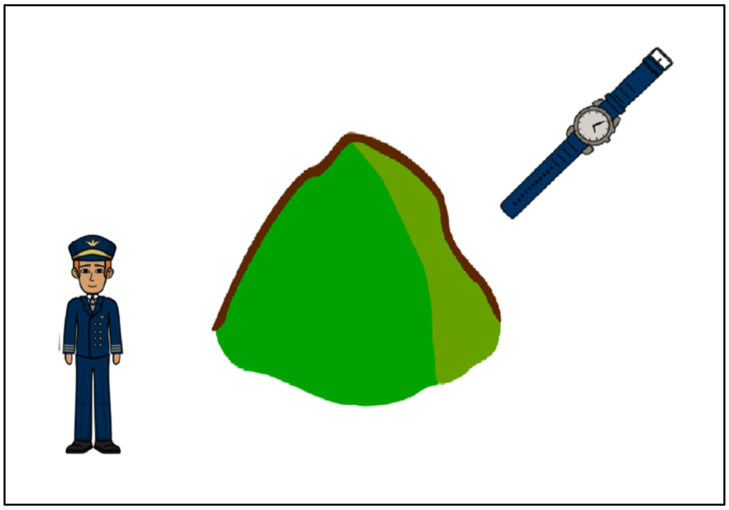


18.



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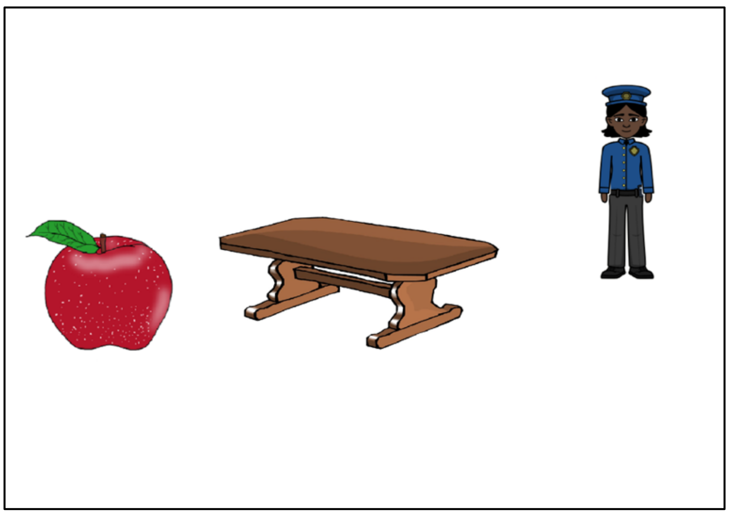

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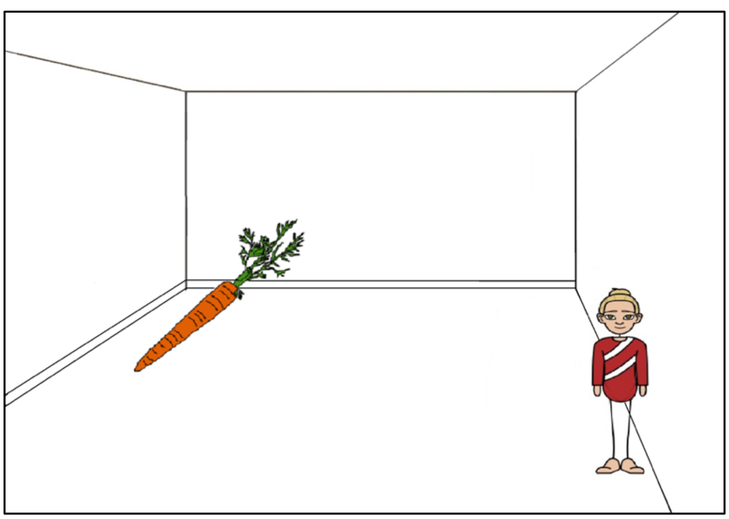

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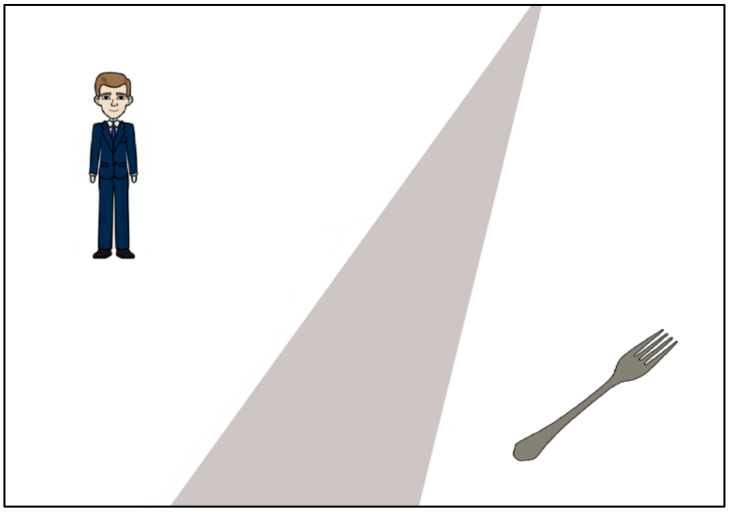

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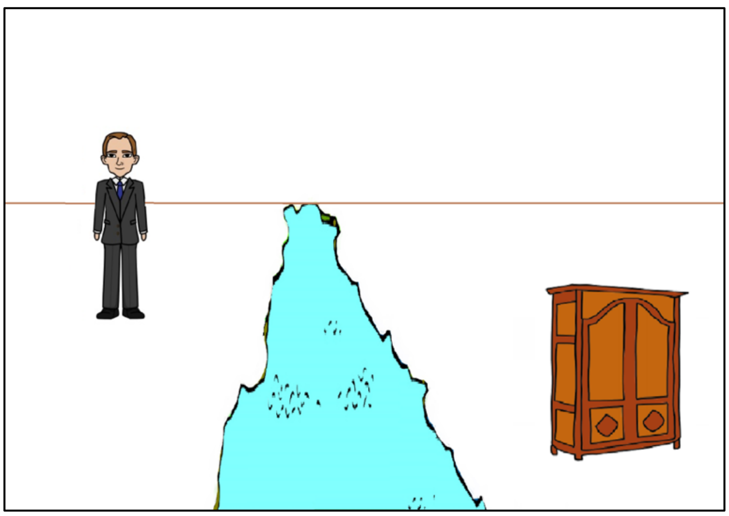

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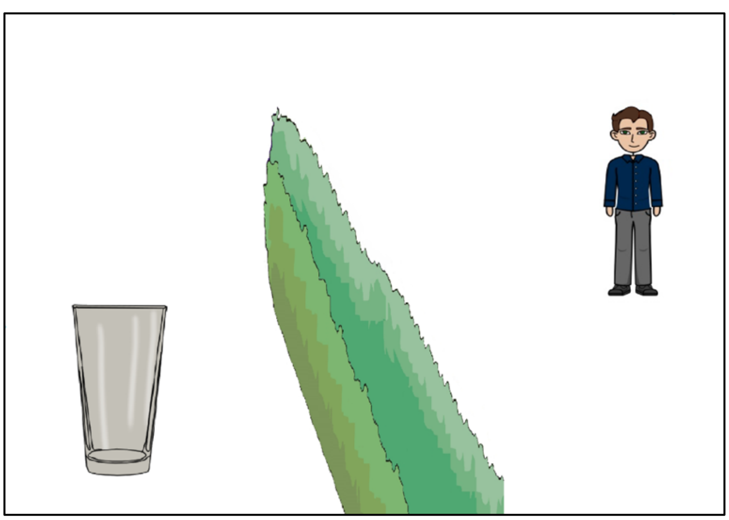
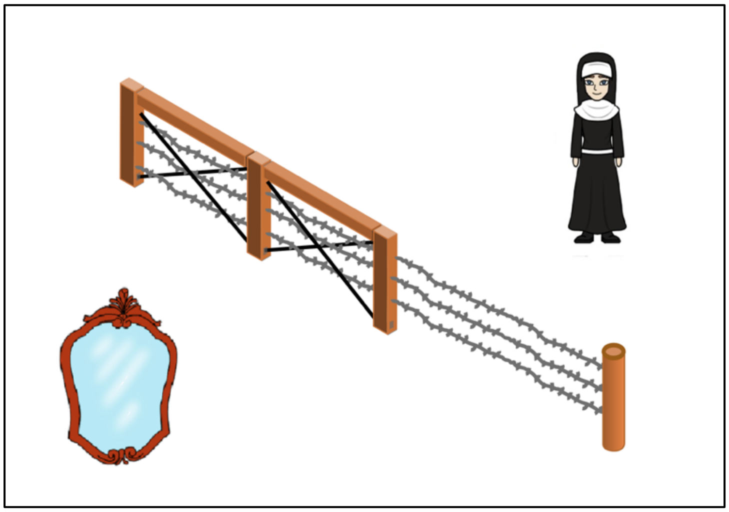


24.

Noncognate mismatch:



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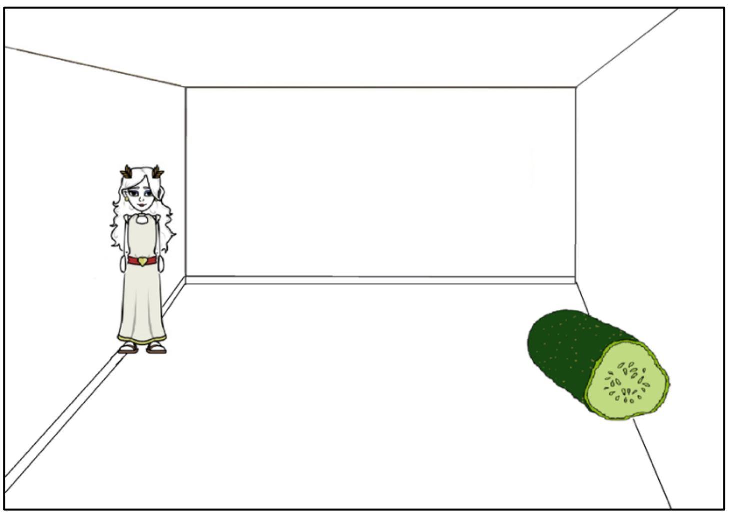

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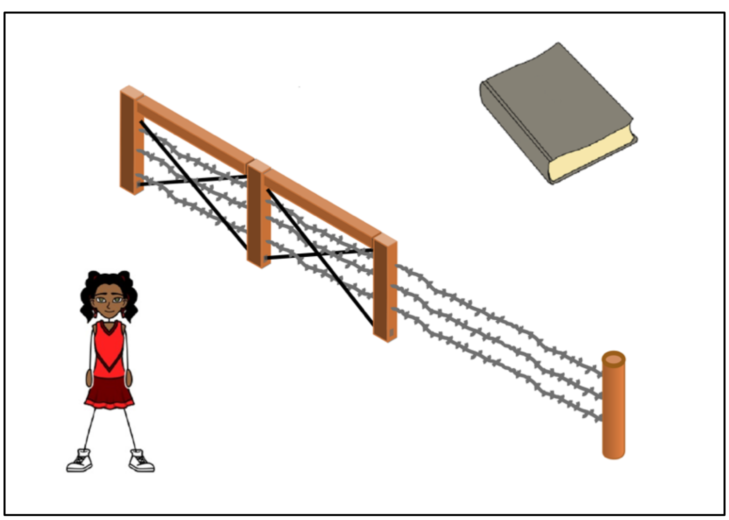

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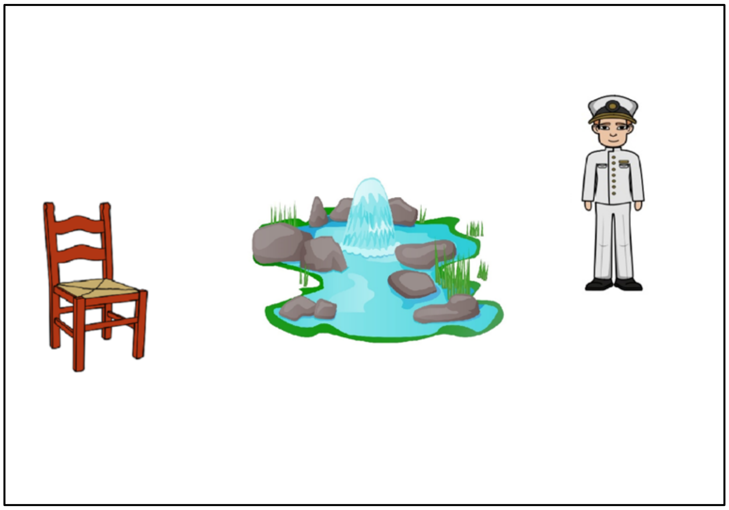

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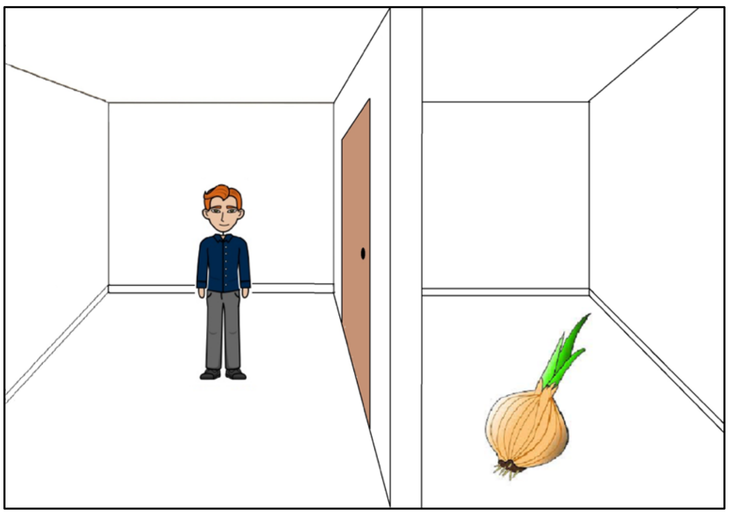

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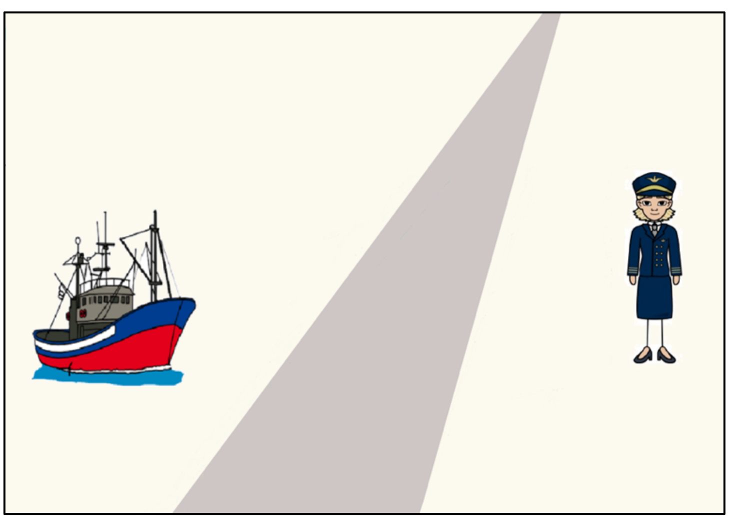
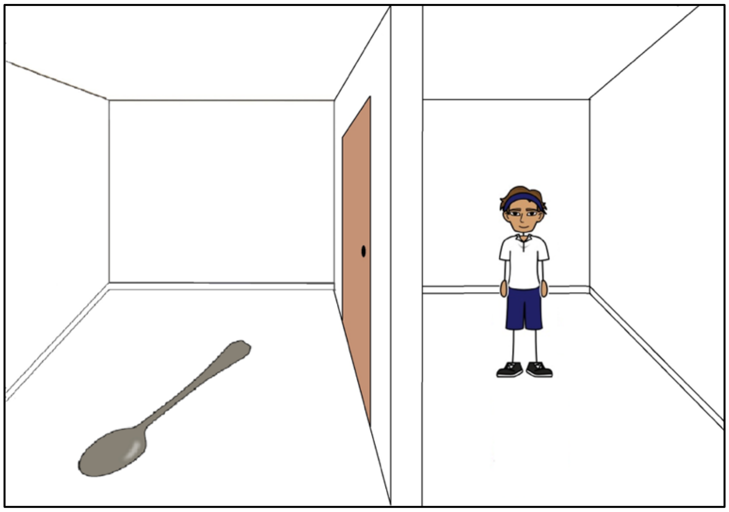
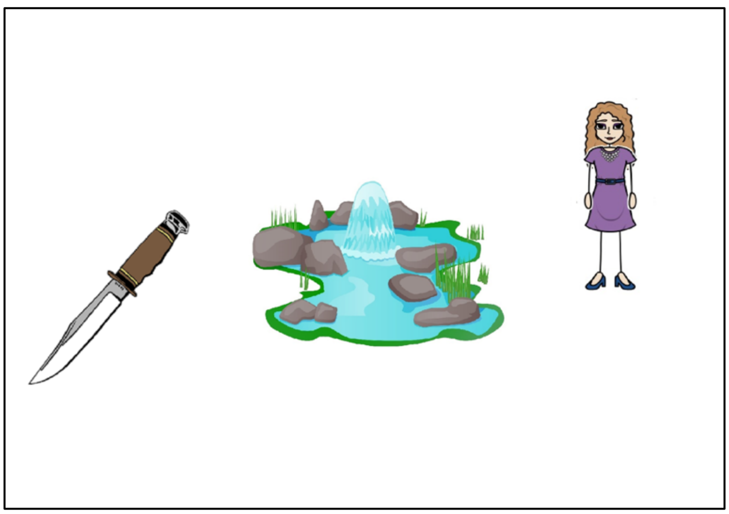


30.

31. 

32. 

Experiment 2: L1 German visual world sentences

LIST 1

Cognate match:

1. Die Banane wird von der Ärztin geschält.

She is across the table.

The doctor needs to go to the other end of the table to grab the banana.

2. Die Mango wird von der Athletin geschnitten.

She is on the other side of the river.

The athlete may cross the river to reach the mango.

3. Der Honig wird von dem Boxer genommen.

He is in the other area.

The boxer needs to jump the fence to reach the honey.

4. Der Apfel wird von dem Koch zerkleinert.

He is across the field.

The chef has to get to the other field to reach the apple.

5. Die Olive wird von der Krankenschwester gegessen.

She is across the canal.

The nurse should cross the canal to reach the olive.

6. Der Ball wird von dem Skifahrer getreten.

He is across the road.

The skier needs to cross the road to reach the ball.

Cognate mismatch:

7. Der Hammer wird von der Ballerina vergraben.

She is on the other side of the bridge.

The ballerina may cross the bridge to reach the hammer.

8. Die Lampe wird von dem Opa angeschaltet.

He is at the other end of the room.

The grandpa should walk to the lamp to turn it on.

9. Der Traktor wird von der Diebin gestohlen.

She is in the other field.

The thief has to cross the road to get to the tractor.

10. Die Garage wird von dem Mechaniker gereinigt.

He is on the other side of the fence.

The mechanic ought to jump the fence to reach the garage.

11. Die Walnuss wird von dem Wissenschaftler genommen.

He is across the path.

The scientist should cross the path to take the walnut.

12. Der Stern wird von der Lehrerin beobachtet.

She is on the other side of the wall.

The teacher can go around the wall to look at the star.

Noncognate match:

13. Der Fleck wird von dem Soldaten entfernt.

He is at the other side of the bridge.

The soldier ought to cross the bridge to get to the stain.

14. Die Kerze wird von der Nonne ausgeblasen.

She is at the other end of the room.

The nun needs to cross the room to get to the candle.

15. Der Teller wird von dem Cheerleader angemalt.

He is across the fence.

The cheerleader has to cross the fence to take the plate.

16. Der Laster wird von dem Piloten verkauft.

He is in the other field.

The pilot must cross the field to get to the truck.

17. Der Korb wird von dem Bräutigam gekauft.

He is in the other room.

The groom has to open the door to reach the basket.

18. Der Eimer wird von dem Absolventen geleert.

He is across the pond.

The graduate should walk around the pond to get to the bucket.

Noncognate mismatch:

19. Die Gabel wird von dem Turner poliert.

He is in the other corner.

The gymnast has to cross the room to get to the fork.

20. Die Birne wird von dem Mann gegriffen.

He is on the other island.

The man should swim to the other island to reach the pear.

21. Der Koffer wird von der Mutter gefunden.

She is on the other side of the bed.

The mother may walk to the other side of the bed to get the suitcase.

22. Die Schüssel wird von dem Polizisten gespült.

He is at the other end of the table.

The police officer should get to the other end of the table to take the bowl.

23. Die Wolke wird von dem Eskimo bewundert.

He is on the other end of the hill.

The eskimo needs to walk over the hill to see the cloud.

24. Der Löffel wird von der Frau gebogen.

She is across the path.

The wife needs to cross the path to reach the spoon.

LIST 2

Cognate match:

1. Der Hammer wird von dem Sträfling vergraben.

He is on the other side of the bridge.

The convict may cross the bridge to reach the hammer.

2. Die Lampe wird von der Oma angeschaltet.

She is at the other end of the room.

The grandma should walk to the lamp to turn it on.

3. Der Traktor wird von dem Dieb gestohlen.

He is in the other field.

The thief has to cross the road to get to the tractor.

4. Die Garage wird von der Mechanikerin gereinigt.

She is on the other side of the fence.

The mechanic ought to jump the fence to reach the garage.

5. Die Walnuss wird von der Wissenschaftlerin genommen.

She is across the path.

The scientist should cross the path to take the walnut.

6. Der Stern wird von dem Lehrer beobachtet.

He is on the other side of the wall.

The teacher can go around the wall to look at the star.

Cognate mismatch:

7. Die Banane wird von dem Arzt geschält.

He is across the table.

The doctor needs to go to the other end of the table to grab the banana.

8. Die Mango wird von dem Athleten geschnitten.

He is on the other side of the river.

The athlete may cross the river to reach the mango.

9. Der Honig wird von der Boxerin genommen.

She is in the other area.

The boxer needs to jump the fence to reach the honey.

10. Der Apfel wird von der Köchin zerkleinert.

She is across the field.

The chef has to get to the other field to reach the apple.

11. Die Olive wird von dem Krankenschwester gegessen.

He is across the canal.

The nurse should cross the canal to reach the olive.

12. Der Ball wird von der Skifahrerin getreten.

She is across the road.

The skier needs to cross the road to reach the ball.

Noncognate match:

13. Die Gabel wird von der Turnerin poliert.

She is in the other corner.

The gymnast has to cross the room to get to the fork.

14. Die Birne wird von der Frau gegriffen.

She is on the other island.

The woman should swim to the other island to reach the pear.

15. Der Koffer wird von dem Vater gefunden.

He is on the other side of the bed.

The father may walk to the other side of the bed to get the suitcase.

16. Die Schüssel wird von der Polizistin gespült.

She is at the other end of the table.

The police officer should get to the other end of the table to take the bowl.

17. Die Wolke wird von der Eskimofrau bewundert.

She is on the other end of the hill.

The eskimo needs to walk over the hill to see the cloud.

18. Der Löffel wird von dem Ehemann gebogen.

He is across the path.

The husband needs to cross the path to reach the spoon.

Noncognate mismatch:

19. Der Fleck wird von der Soldatin entfernt.

She is at the other side of the bridge.

The soldier ought to cross the bridge to get to the stain.

20. Die Kerze wird von dem Priester ausgeblasen.

He is at the other end of the room.

The priest needs to cross the room to get to the candle.

21. Der Teller wird von der Cheerleaderin angemalt.

She is across the fence.

The cheerleader has to cross the fence to take the plate.

22. Der Laster wird von der Pilotin verkauft.

She is in the other field.

The pilot must cross the field to get to the truck.

23. Der Korb wird von der Braut gekauft.

She is in the other room.

The bride has to open the door to reach the basket.

24. Der Eimer wird von der Absolventin geleert.

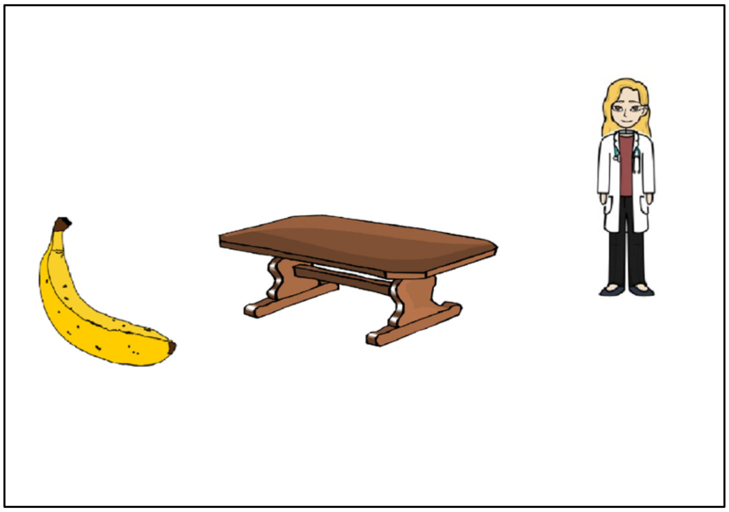
She is across the pond.

The graduate should walk around the pond to get to the bucket.

Experiment 2: L1 German visual world pictures

LIST 1

Cognate match:



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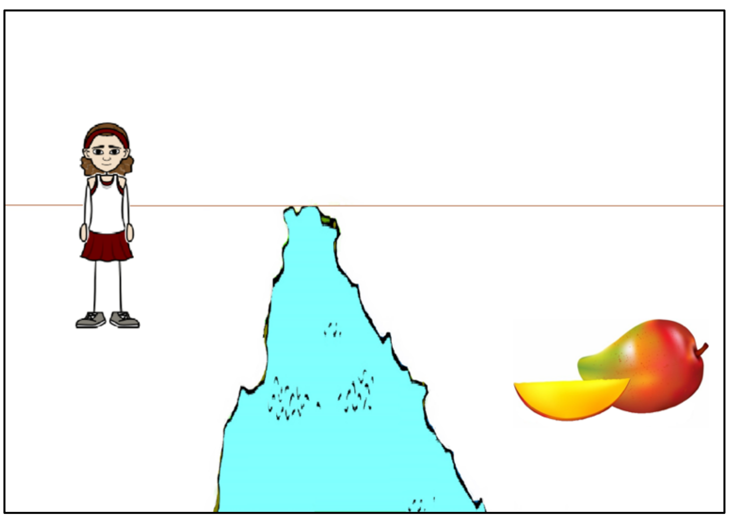

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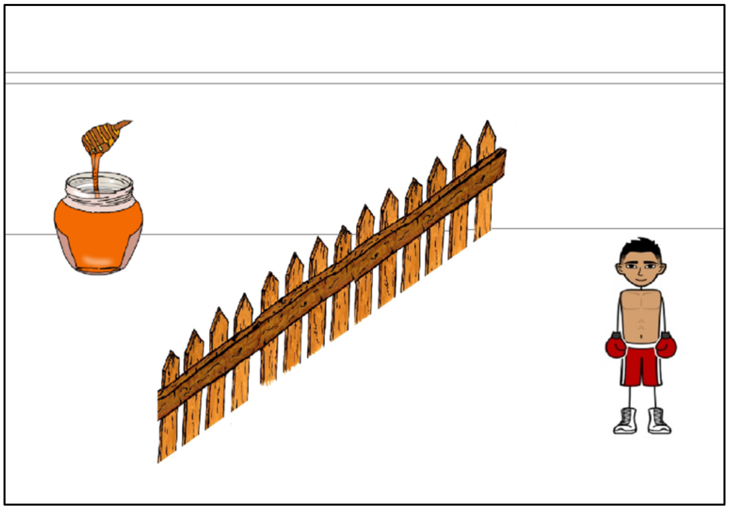

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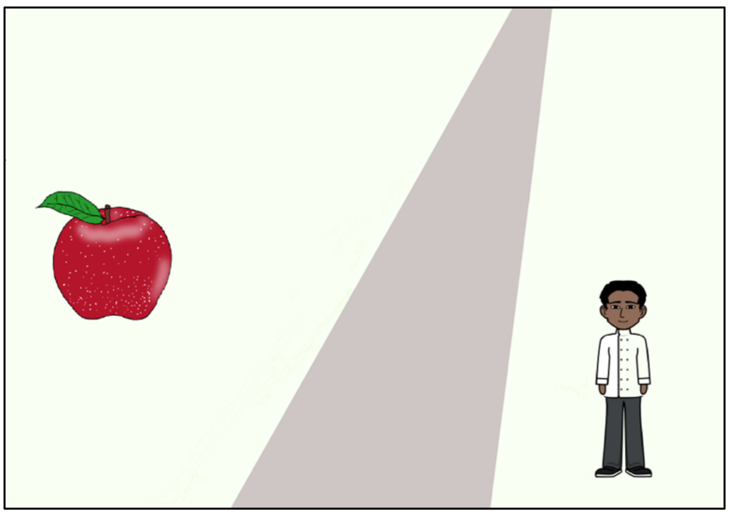

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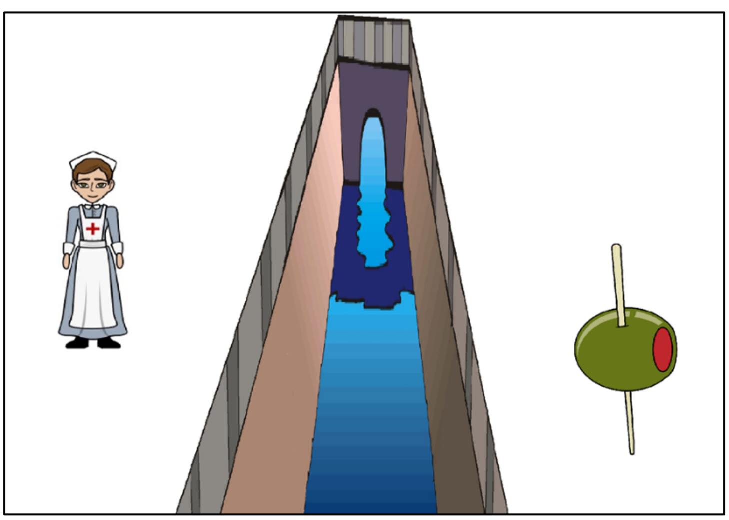

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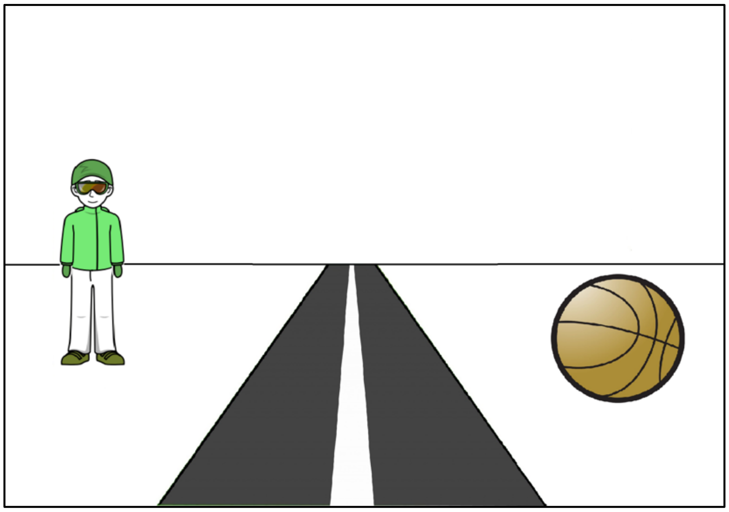
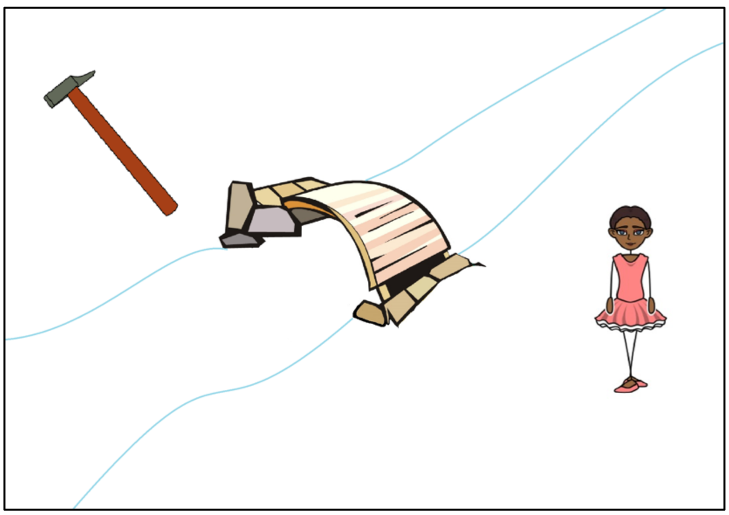
6.


Cognate mismatch:

7.


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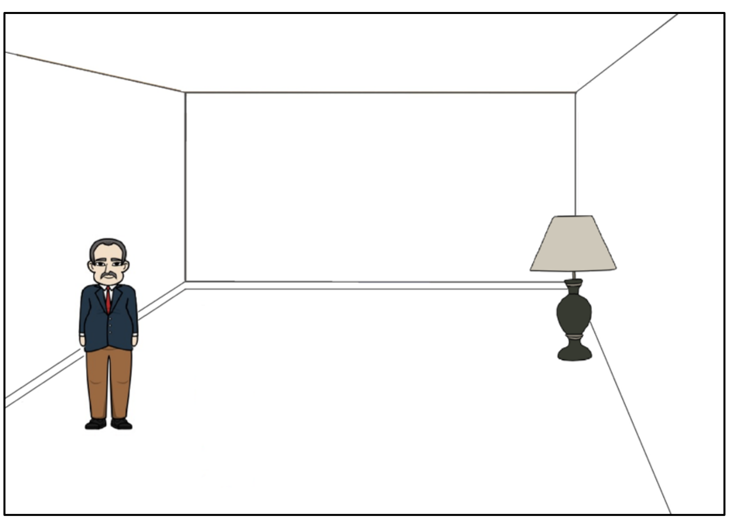
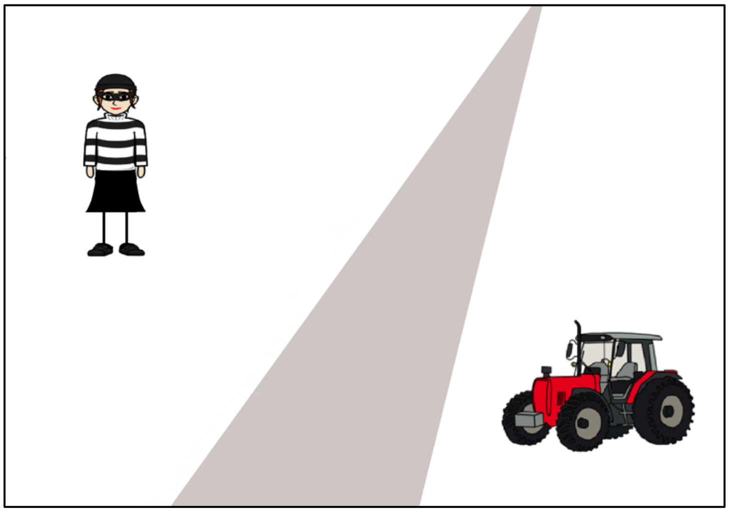
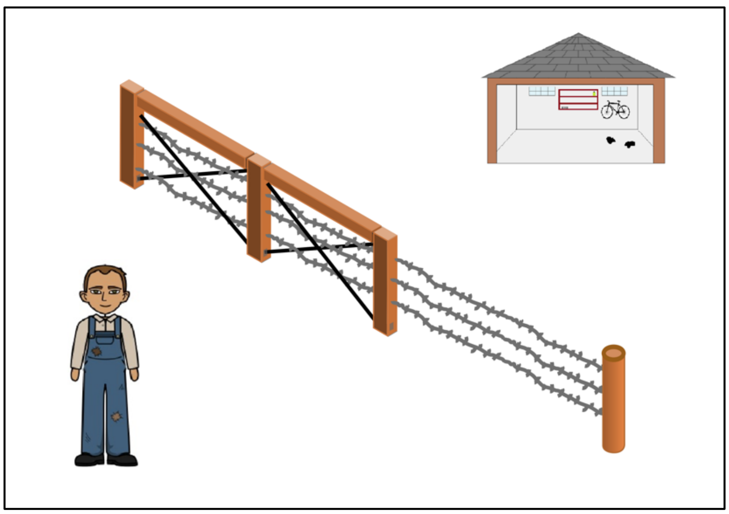
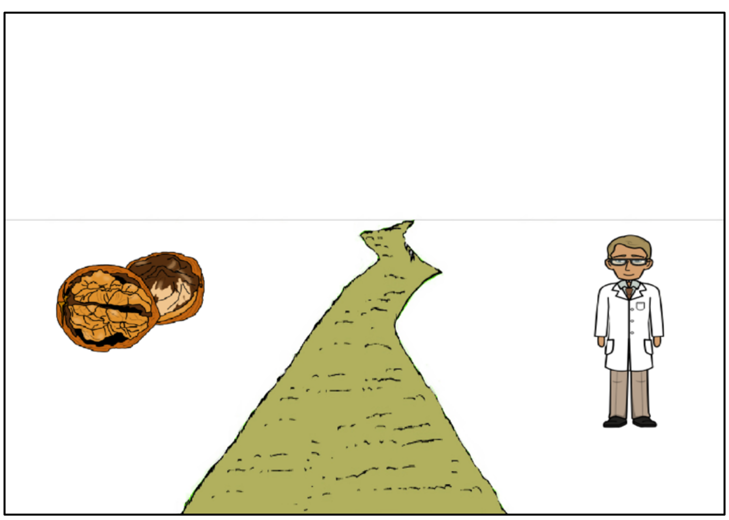
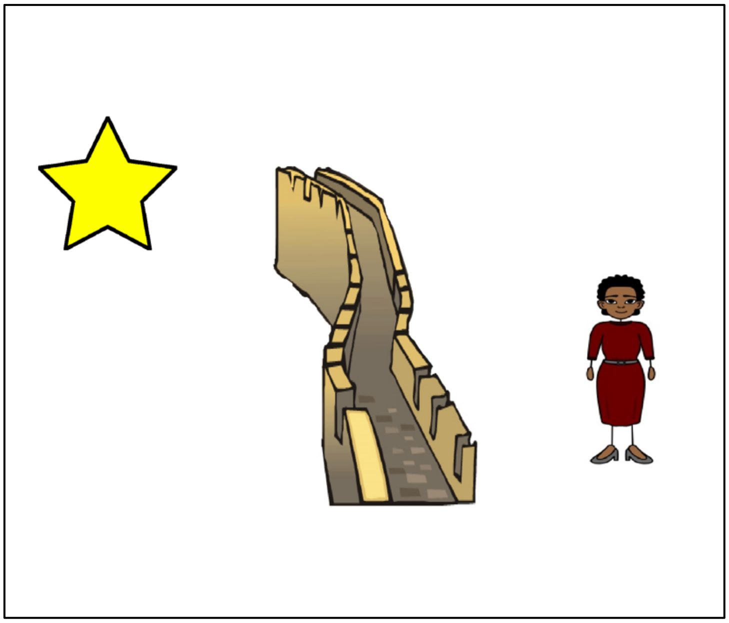


9. 

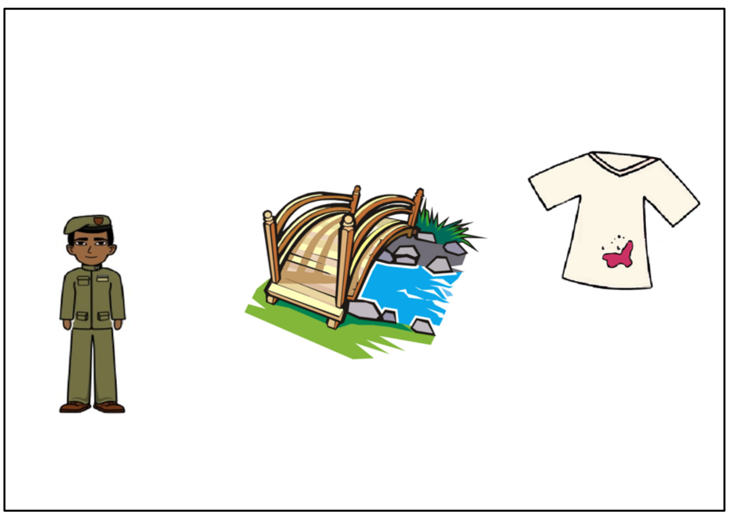
10. 

11. 



12.

Noncognate match:



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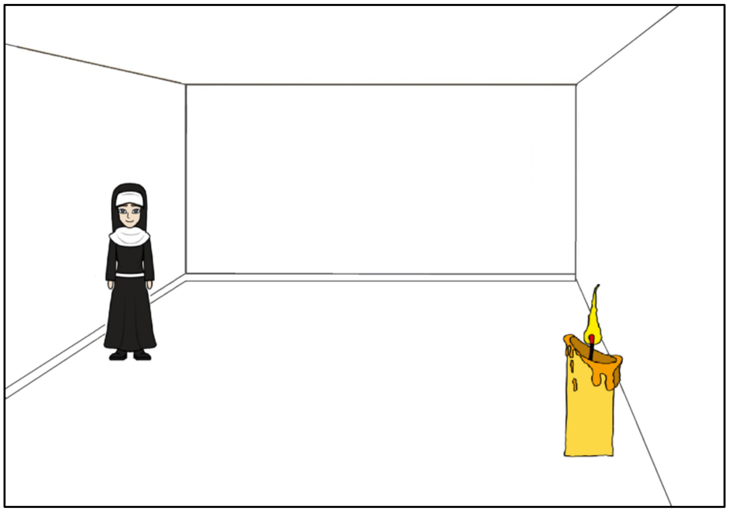

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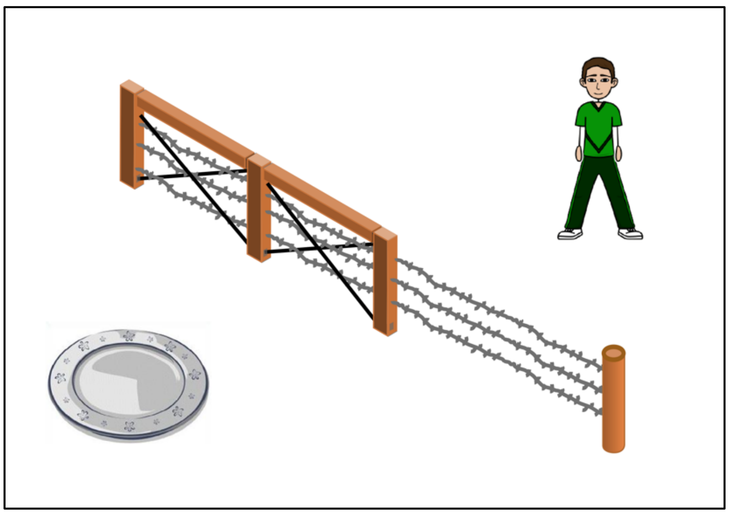

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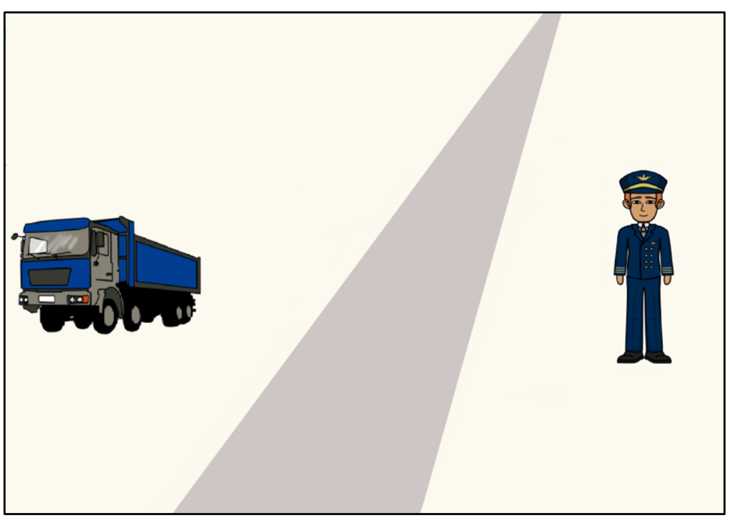

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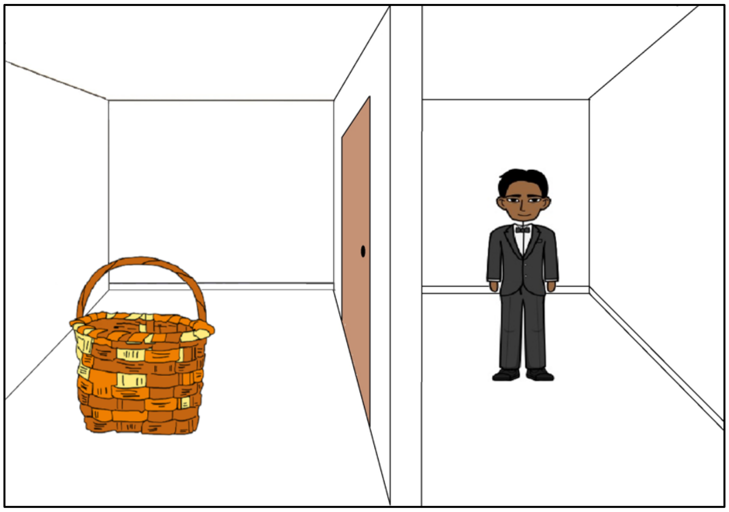
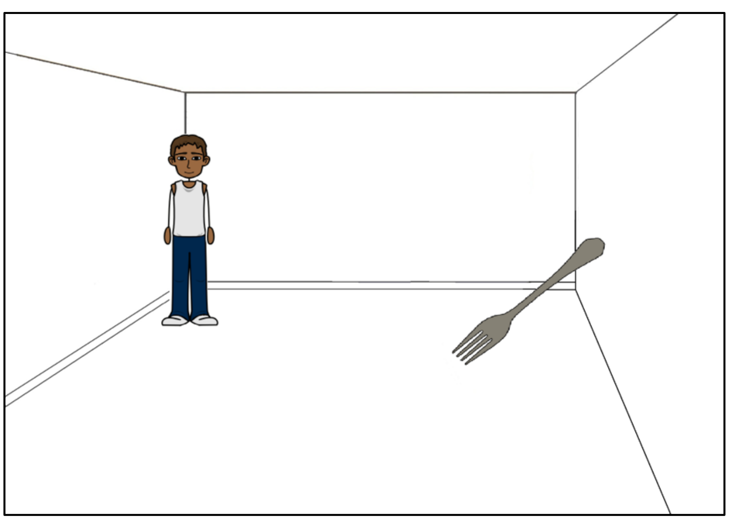

17.


18.

Noncognate mismatch: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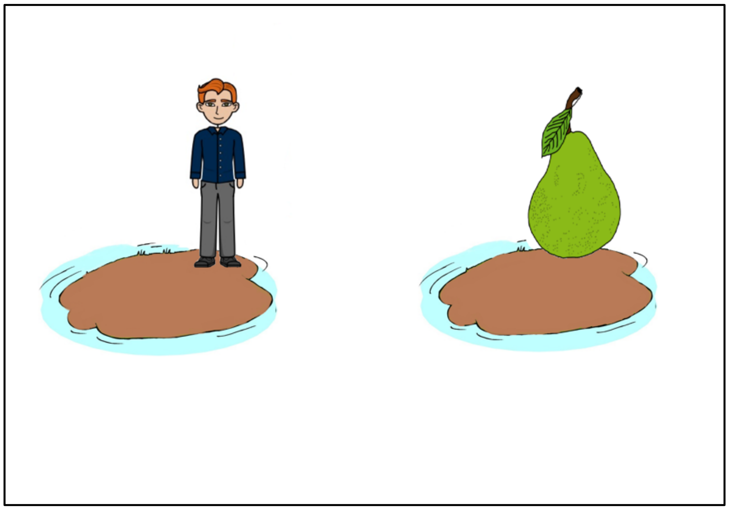

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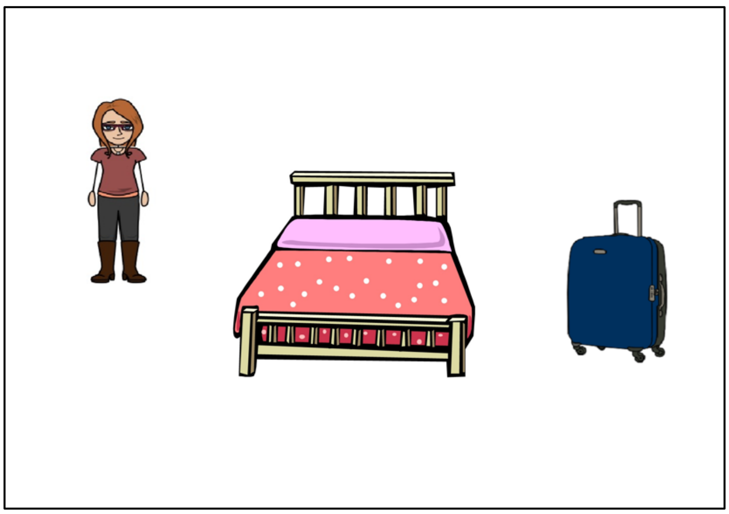

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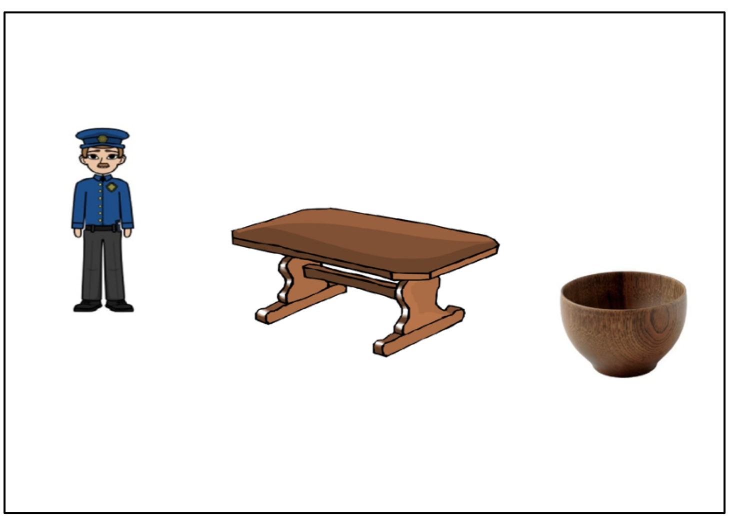

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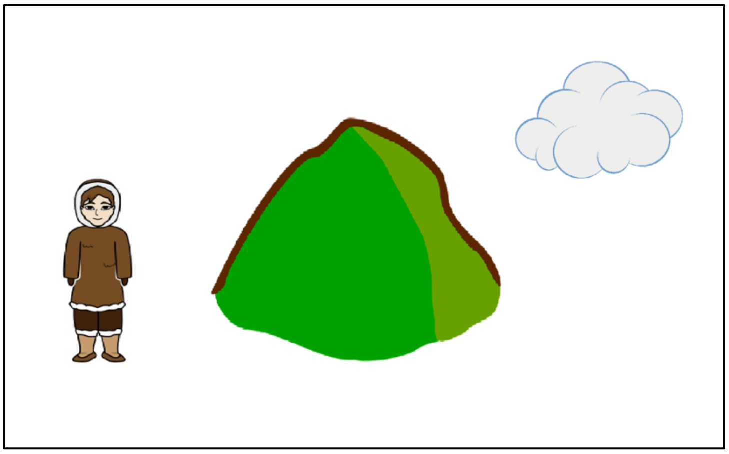

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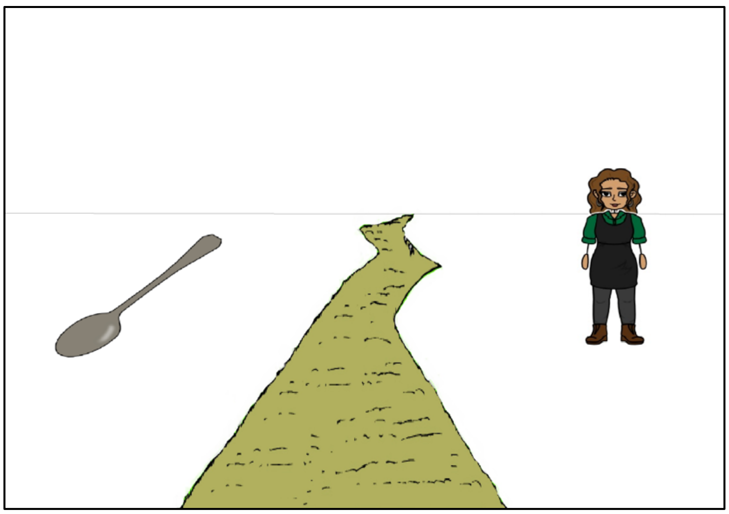
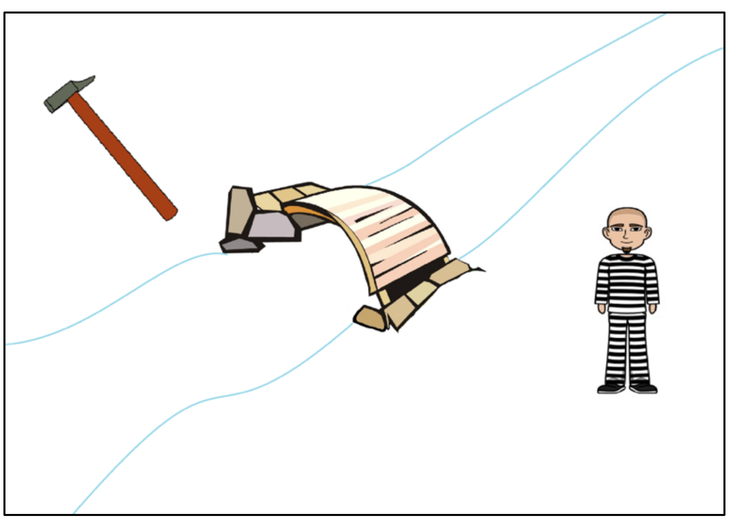


24.

LIST 2

Cognate match:



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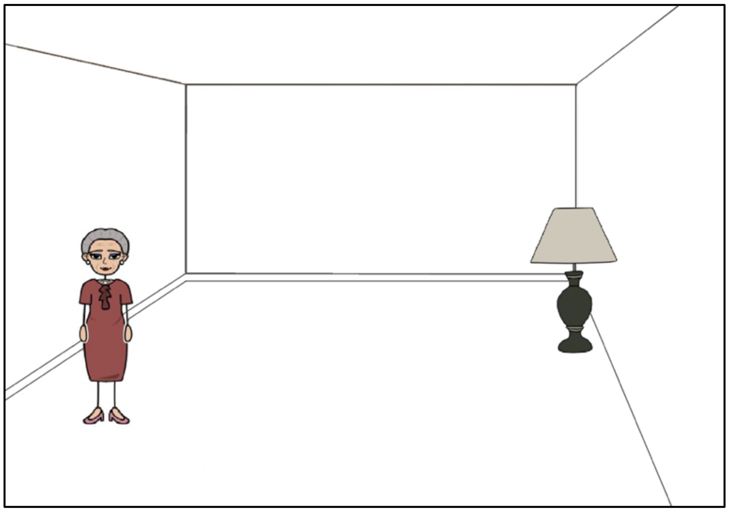

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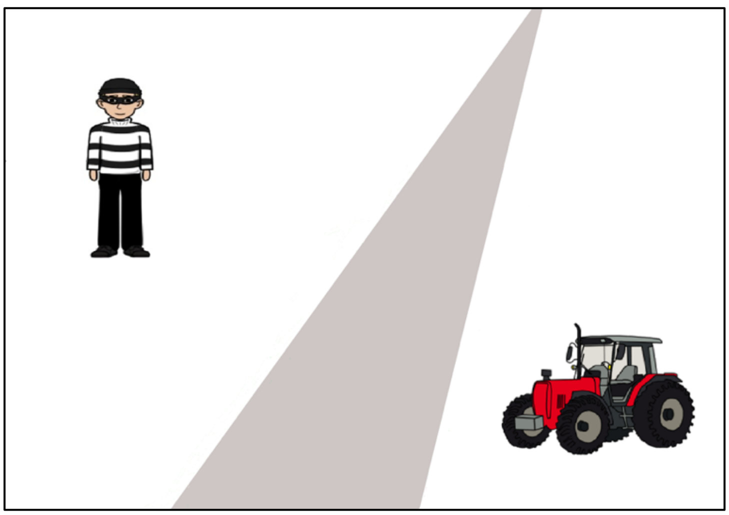

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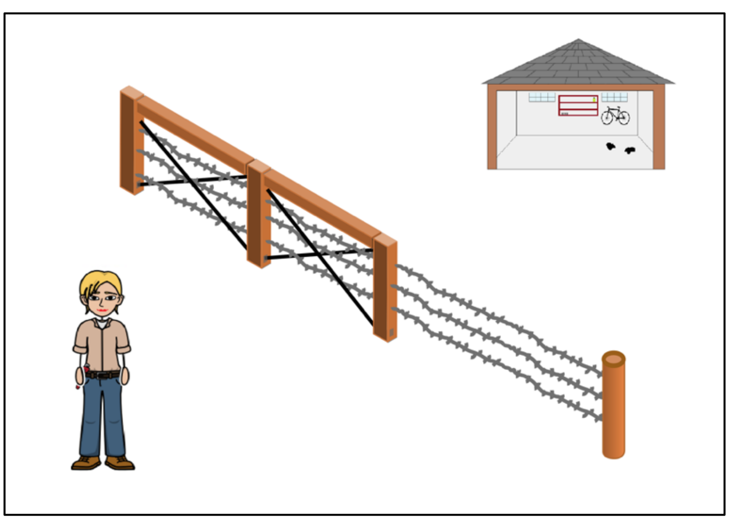

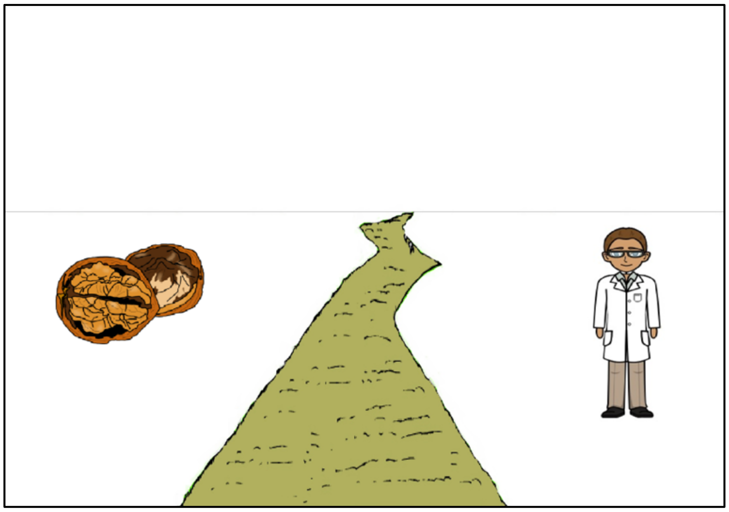

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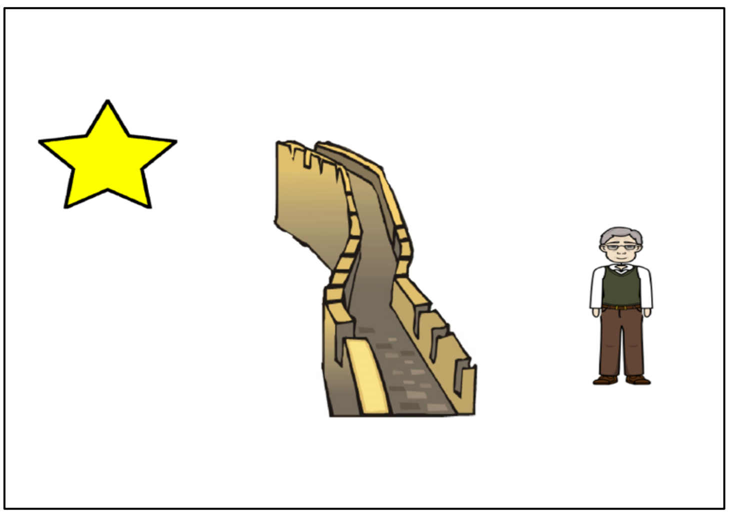
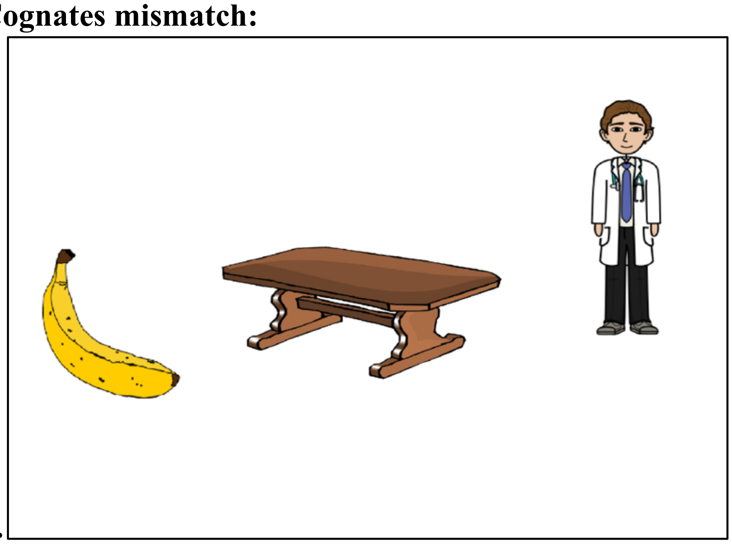


6.

Cognates mismatch:



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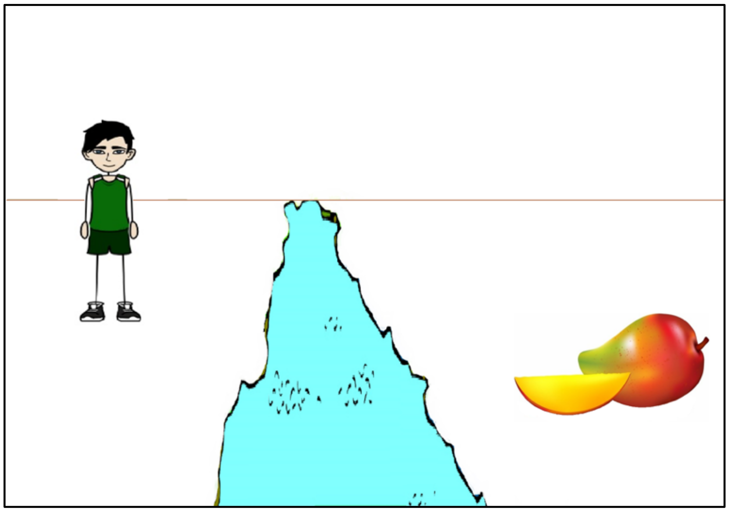

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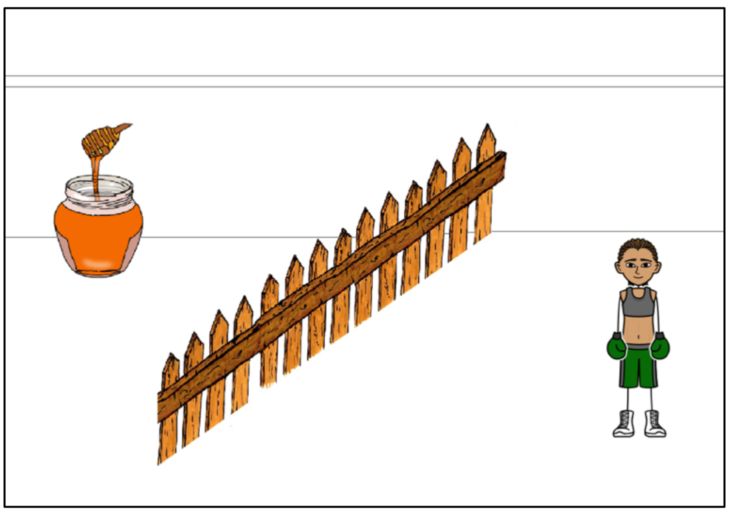

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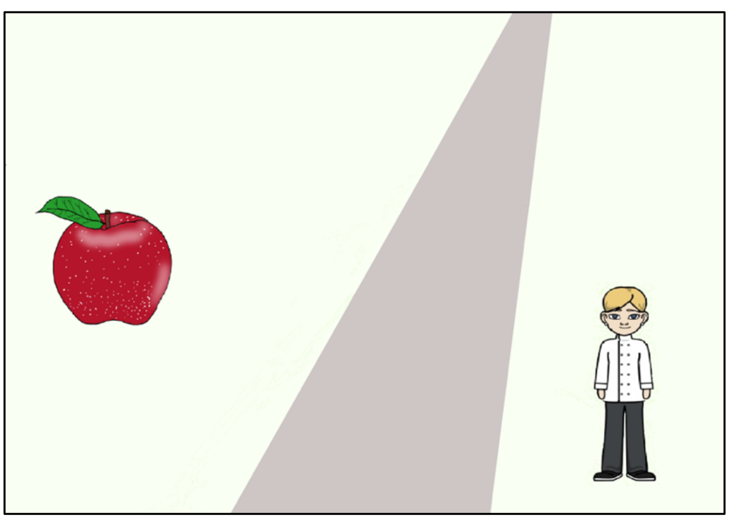

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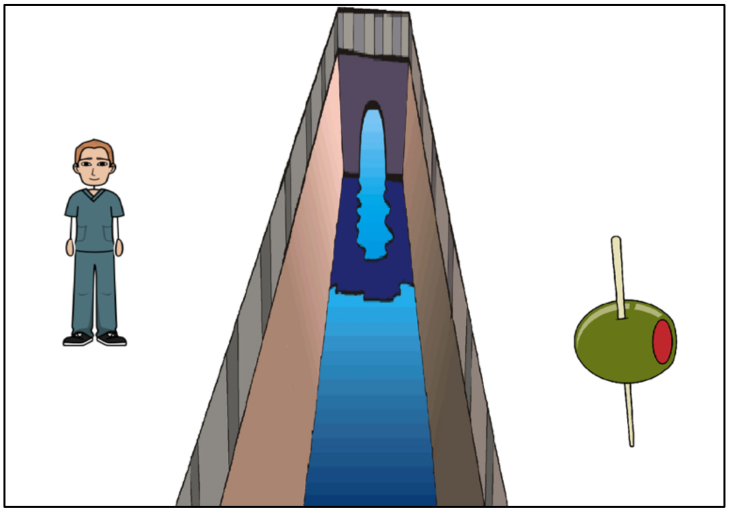

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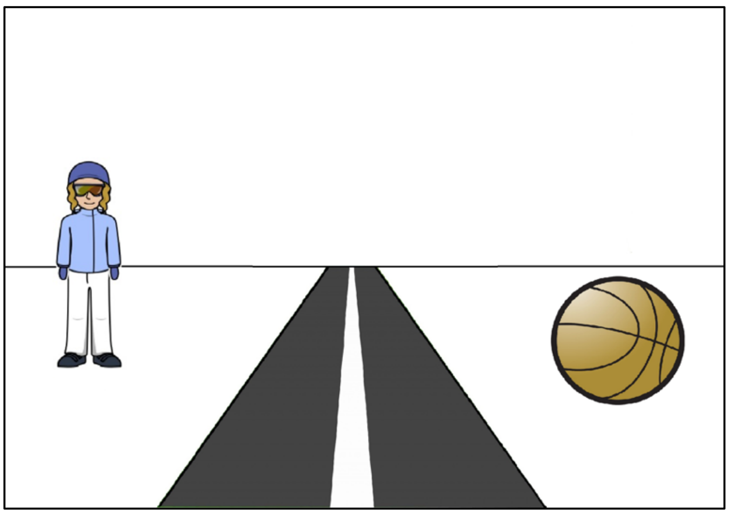
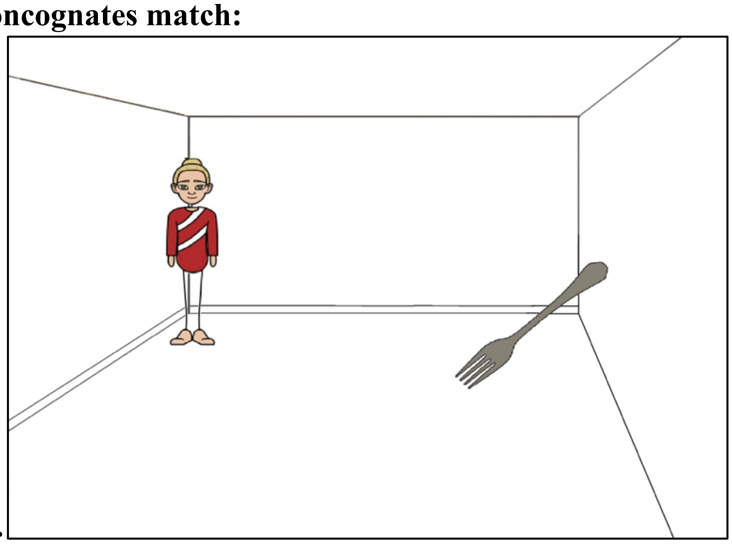


12.

Noncognates match:



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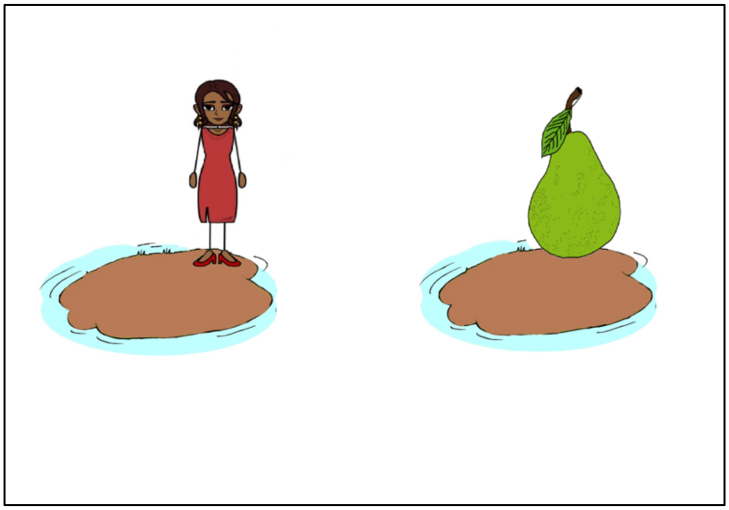

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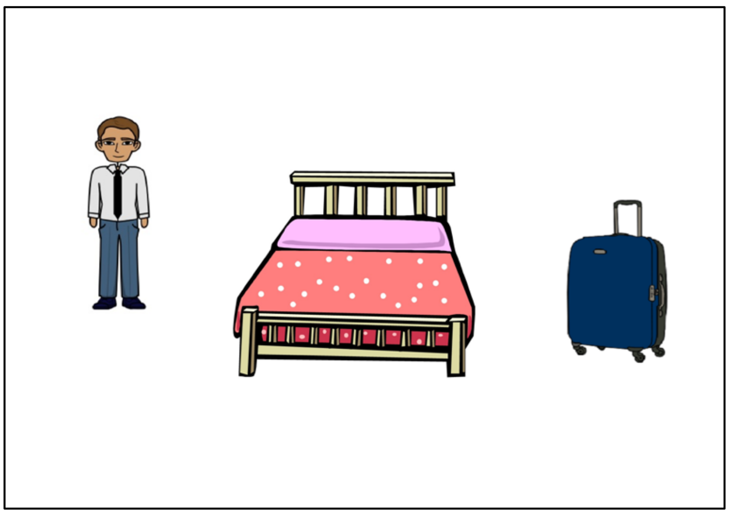

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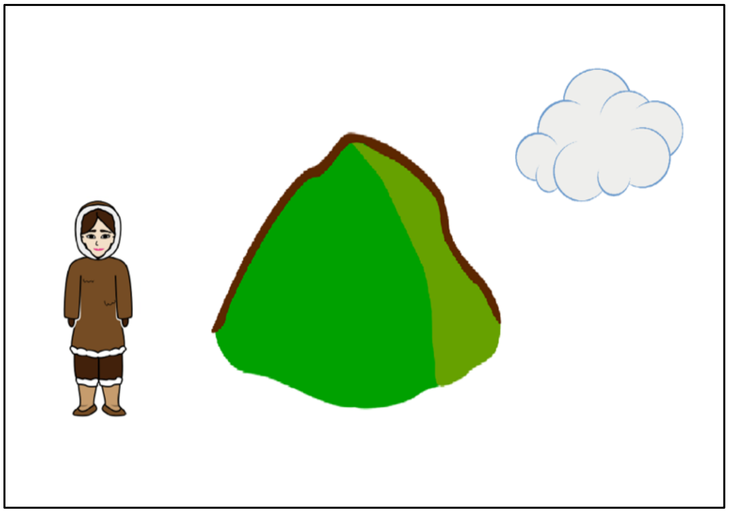
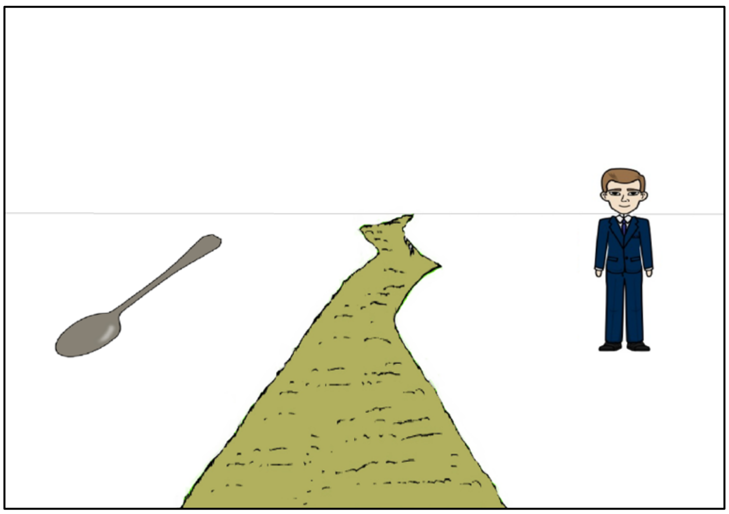
16.

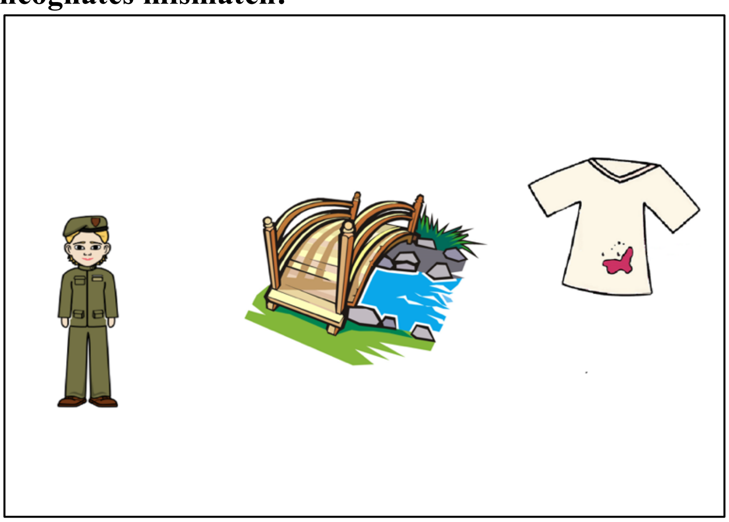


17.

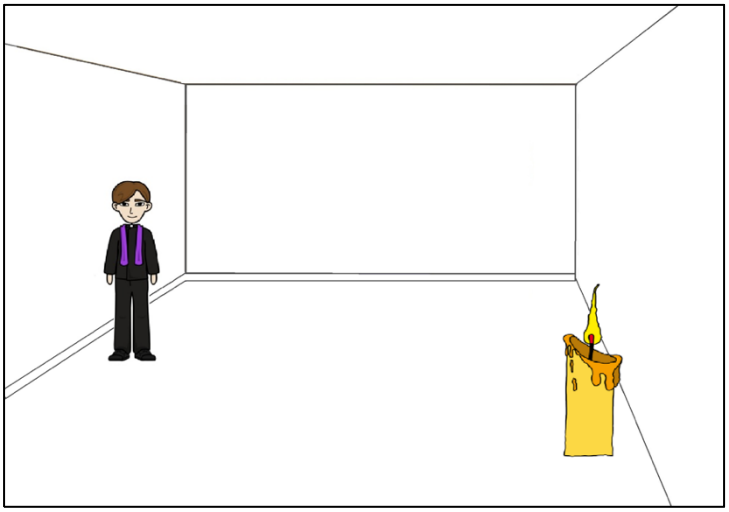


18.

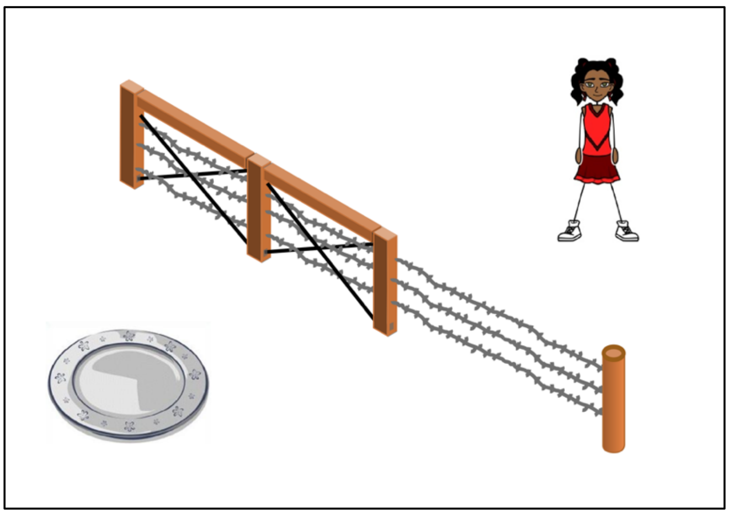
Noncognates mismatch:



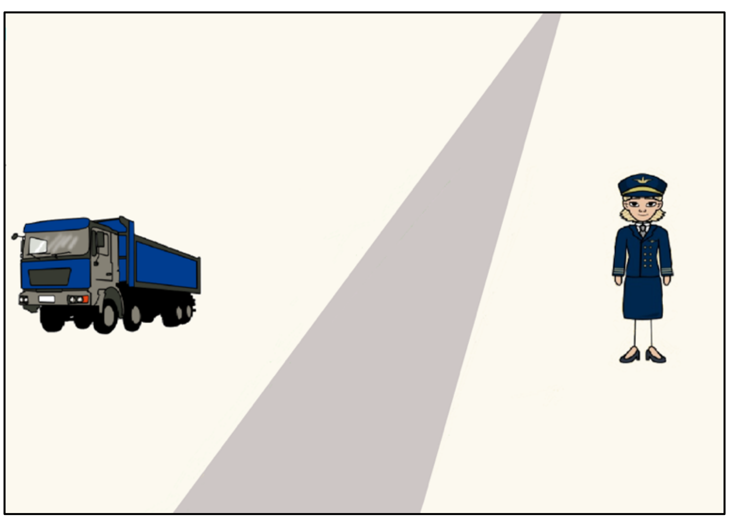
19.



20.



21.



22.

23.

24.

Appendix A: III – Croatian LexTALE

Word	English translation	Length	Word class	Frequency (per million)	Word type	Non words
dužnost	duty	7	Noun	26	word	–
ostvarili	achieve	9	Verb participle	21	word	–
prekrasna	beautiful	9	Verb	7,3	word	–
crvenilo	redness	9	Noun	3,9	word	–
trud	effort	4	Noun	19,4	word	–
zanos	fervor	5	Noun	1,9	word	–
dogovoreni	arranged	10	Adjective	2,6	word	–
postavljali	to set up	11	Verb participle	2,8	word	–
nastajanje	formation	10	Noun	2,1	word	–
divno	lovely	5	Adverb	10,6	word	–
obala	shore	5	Noun	9	word	–
koristan	useful	8	Adjective	8,6	word	–
napredovanje	advancement	12	Noun	4,8	word	–
glatko	smooth	6	Adjective	7,4	word	–
bora	wrinke	4	Noun	7,1	word	–
vojnik	soldier	6	Noun	8,1	word	–
produžena	prolonged	9	Adjective	1,6	word	–
vodeća	leading	6	Adjective	6,6	word	–
unutrašnjost	interior	12	Noun	9,5	word	–
novinarstvo	journalism	11	Noun	5,4	word	–
imenovati	to name	9	Verb	5,1	word	–
lane	last/deer	4	Adj/Noun	3,6	word	–
blizina	vicinity	7	Noun	4,4	word	–
skriveno	hidden	8	Adjective	2,8	word	–
omiljen	favorite	6	Adjective	2,5	word	–
dugme	button	5	Noun	2,2	word	–
progovoriti	to start speaking	11	Verb	4	word	–
izgrađen	built	0	Adjective	8,3	word	–
dvoboj	duel	6	Noun	11,4	word	–
odredba	regulation	7	Noun	5,8	word	–

odgojiti	to raise	8	Verb	1,7	word	–
simpatično	cute	10	Adverb	3,1	word	–
nesposobnost	incompetence	12	Noun	4,4	word	–
ugrađen	built in	7	Adjective	6,8	word	–
oprezan	cautious	7	Adjective	4,8	word	–
otisak	imprint	6	Noun	2,4	word	–
plašiti	to scare	7	Verb	1,7	word	–
ravnopravnost	equality	13	Noun	7,7	word	–
udarni	percussive	6	Adjective	1,3	word	–
prometna	crowded	8	Adjective	6,1	word	–
nekretnina	real estate	10	Noun	25	non word	zakretnina
brižljivo	carefully	8	Adverb	1,3	non word	blažljivo
razmišljati	to think	10	Verb	23,3	non word	razkašljati
plivanje	swimming	8	Noun	5	non word	ploranje
svemirska	universal	9	Adjective	2,1	non word	svetarska
pokazatelj	indicator	9	Noun	12,6	non word	povezatelj
radnja	action/shop	5	Noun	9,7	non word	kudnja
srednji	middle	6	Adjective	8,6	non word	sredra
prag	treshold	4	Noun	7,7	non word	slag
zgodan	handsome	6	Adjective	6,5	non word	zgasan
ušlo	to get in	4	Verb participle	5,3	non word	avlo
tužan	sad	5	Adjective	4,8	non word	mežan
sunčano	sunny	7	Adjective	3,7	non word	savčano
pastir	shepherd	6	Noun	2,3	non word	lestir
zbrka	mess	5	Noun	1,6	non word	zbrlo
ukradena	stolen	8	Adjective	1,5	non word	ozradena
nagle	sudden	5	Adjective	1,9	non word	nagob
krivac	offender	6	Noun	8,3	non word	krazac
gašenje	extinguishing	6	Noun	6,8	non word	sišenje
suprotnost	opposite	10	Noun	4,8	non word	naprotnost
	Total length	7,36666667	Total frequency	6,643333333		
			Words frequency	6,395		

Appendix A: IV – Tables

Experiment 1: L1 German

Table 141. Experiment 1: A separate analysis of TW1 with cognates only for the L1 German group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-5.21	1.35	-3.85	< .001
Congruency	2.46	1.09	2.25	**.02**
Trial	-0.48	0.13	-3.80	**.001**
Congruency*Trial	0.65	0.15	4.50	**.001**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 142. Experiment 1: A separate analysis of TW1 with noncognates only for the L1 German group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-2.80	0.92	-3.03	.002
Congruency	-0.17	0.93	-0.18	.86
Trial	0.26	0.06	4.13	**.001**
Congruency*Trial	0.07	0.09	0.79	.43

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 143. Experiment 1: A separate analysis of TW2 with cognates only for the L1 German group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-5.32	1.50	-3.55	< .001
Congruency	3.33	1.12	2.97	**.003**
Trial	-2.56	0.18	-13.91	**.001**
Congruency*Trial	2.15	0.20	10.89	**.001**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 144. Experiment 1: A separate analysis of TW2 with noncognates only for the L1 German group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-2.24	0.62	-3.64	.001
Congruency	0.44	0.59	0.75	.46
Trial	0.21	0.06	3.43	**.001**
Congruency*Trial	-0.16	0.08	-1.84	.07

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 145. Experiment 1: A separate analysis on the effects of Congruency on cognates by time window (TW1 and TW2) and by Trial (first and second half) for the L1 German group

	Estimate	SE	*z*-value	*p*-value
First Half – TW1	14.75	0.00	54266	**< .001**
First Half – TW2	-7.81	3.92	-1.99	**.05**
Second Half – TW1	8.40	2.92	2.88	**.004**
Second Half – TW2	21.43	4.94	4.34	**.001**

Formula in R: *Fixation ~ Congruency + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 146. Experiment 1: A separate analysis on the effects of Congruency on cognates by time window (TW1 and TW2) and by Trial (first and second half) for the L1 German group

	Estimate	SE	*z*-value	*p*-value
First Half – TW1	-4.50	2.04	-2.2	**.03**
First Half – TW2	-12.3	4.56	-2.7	**.007**
Second Half – TW1	35.78	3.76	9.53	**.001**
Second Half – TW2	24.61	5.76	4.27	**.001**

Formula in R: *Fixation ~ Congruency + (1+Congruency|Participant) + (1+Congruency|Item)*

Experiment 2: L1 Croatian

Table 147. Experiment 2: A separate analysis of TW1 with cognates only for the L1 Croatian group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.06	0.25	-4.28	<.001
Congruency	-0.01	0.41	-0.04	.97
Trial	0.46	0.03	13.65	**.001**
Congruency*Trial	-0.40	0.05	-7.91	**.001**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 148. Experiment 2: A separate analysis of TW1 with noncognates only for the L1 Croatian group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.88	0.30	-6.35	< .001
Congruency	0.23	0.43	0.53	.60
Trial	-0.31	0.04	-8.15	**.001**
Congruency*Trial	0.37	0.06	6.59	**.001**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 149. Experiment 2: A separate analysis of TW2 with cognates only for the L1 Croatian group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-0.74	0.21	-3.45	< .001
Congruency	-0.44	0.36	-1.22	.22
Trial	0.31	0.03	9.12	**.001**
Congruency*Trial	-0.09	0.05	-1.69	**.09**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 150. Experiment 2: A separate analysis of TW2 with noncognates only for the L1 Croatian group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-2.18	0.33	-6.59	< .001
Congruency	1.10	0.51	2.13	**.03**
Trial	-0.04	0.04	-1.06	.29
Congruency*Trial	0.46	0.06	7.87	**.001**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 151. Experiment 2: A separate analysis on the effects of Congruency on cognates by time window (TW1 and TW2) and by Trial (first and second half) for the L1 Croatian group

	Estimate	SE	*z*-value	*p*-value
First Half – TW1	1.24	0.65	1.92	.06
First Half – TW2	-0.16	0.81	-0.2	.84
Second Half – TW1	-1.42	0.78	-1.82	**.07**
Second Half – TW2	-1.49	0.8	-1.86	**.06**

Formula in R: *Fixation ~ Congruency + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 152. Experiment 2: A separate analysis on the effects of Congruency on noncognates by time window (TW1 and TW2) and by Trial (first and second half) for the L1 Croatian group

	Estimate	SE	*z*-value	*p*-value
First Half – TW1	-2.05	1.25	-1.64	.10
First Half – TW2	1.78	1.18	1.51	.13
Second Half – TW1	1.67	1.06	1.57	.12
Second Half – TW2	2.73	1.13	2.42	**.02**

Formula in R: *Fixation ~ Congruency + (1+Congruency|Participant) + (1+Congruency|Item)*

Experiment 2: L1 Spanish

Table 153. Experiment 2: A separate analysis of TW1 with cognates only for the L1 Spanish group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.57	0.41	-3.85	< .001
Congruency	-0.32	0.58	-0.55	.59
Trial	-0.19	0.05	-3.80	**.001**
Congruency*Trial	0.07	0.07	1.06	.29

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 154. Experiment 2: A separate analysis of TW1 with noncognates only for the L1 Spanish group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.38	0.51	-2.69	.007
Congruency	-0.29	0.56	-0.52	.61
Trial	0.35	0.06	6.22	**.001**
Congruency*Trial	-0.31	0.08	-4.10	**.001**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 155. Experiment 2: A separate analysis of TW2 with cognates only for the L1 Spanish group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.11	0.32	-3.49	< .001
Congruency	-0.46	0.47	-0.98	.33
Trial	-0.22	0.05	-4.54	**.001**
Congruency*Trial	0.16	0.07	2.38	**.02**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 156. Experiment 2: A separate analysis of TW2 with noncognates only for the L1 Spanish group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.32	0.48	-2.76	.006
Congruency	-0.11	0.49	-0.23	.82
Trial	0.42	0.05	7.77	**.001**
Congruency*Trial	-0.35	0.07	-4.68	**.001**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 157. Experiment 2: A separate analysis on the effects of Congruency on cognates by time window (TW1 and TW2) and by Trial (first and second half) for the L1 Spanish group

	Estimate	SE	*z*-value	*p*-value
First Half – TW1	0.75	1.96	0.38	.70
First Half – TW2	0.33	1.43	0.23	.82
Second Half – TW1	-1.20	1.76	-0.68	.50
Second Half – TW2	-0.75	1.88	-0.4	.69

Formula in R: *Fixation ~ Congruency + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 158. Experiment 2: A separate analysis on the effects of Congruency on noncognates by time window (TW1 and TW2) and by Trial (first and second half) for the L1 Spanish group

	Estimate	SE	*z*-value	*p*-value
First Half – TW1	-0.18	1.53	-0.12	.91
First Half – TW2	1.49	2.84	0.52	.60
Second Half – TW1	-0.42	1.25	-0.34	.74
Second Half – TW2	-0.17	1.52	-0.11	.91

Formula in R: *Fixation ~ Congruency + (1+Congruency|Participant) + (1+Congruency|Item)*

Experiment 2: L1 German

Table 159. Experiment 2: A separate analysis of TW1 with cognates only for the L1 German group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-1.13	0.53	-2.14	.03
Congruency	-1.13	1.12	-1.02	.31
Trial	-0.03	0.07	-0.47	.64
Congruency*Trial	-0.45	0.12	-3.80	**.001**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 160. Experiment 2: A separate analysis of TW1 with noncognates only for the L1 German group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-0.99	0.42	-2.35	.02
Congruency	0.14	0.47	0.29	.77
Trial	0.05	0.06	0.80	.43
Congruency*Trial	-0.16	0.08	-1.97	**.05**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 161. Experiment 2: A separate analysis of TW2 with cognates only for the L1 German group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-0.23	0.56	-0.4	.69
Congruency	-1.91	0.94	-2.03	**.04**
Trial	-0.45	0.08	-5.97	**.001**
Congruency*Trial	-0.32	0.12	-2.75	**.006**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 162. Experiment 2: A separate analysis of TW2 with noncognates only for the L1 German group

	Estimate	SE	*z*-value	*p*-value
(Intercept)	-0.64	0.49	-1.31	.19
Congruency	-0.26	0.69	-0.39	.70
Trial	-0.31	0.07	-4.58	**.001**
Congruency*Trial	0.91	0.09	9.66	**.001**

Formula in R: *Fixation ~ Congruency*Trial + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 163. Experiment 2: A separate analysis on the effects of Congruency on cognates by time window (TW1 and TW2) and by Trial (first and second half) for the L1 German group

	Estimate	SE	*z*-value	*p*-value
First Half – TW1	-0.80	2.12	-0.38	.71
First Half – TW2	-3.33	2.22	-1.5	.13
Second Half – TW1	-10.03	3.88	-2.59	**.01**
Second Half – TW2	-50.06	6.48	-7.73	**.001**

Formula in R: *Fixation ~ Congruency + (1+Congruency|Participant) + (1+Congruency|Item)*

Table 164. Experiment 2: A separate analysis on the effects of Congruency on noncognates by time window (TW1 and TW2) and by Trial (first and second half) for the L1 German group

	Estimate	SE	*z*-value	*p*-value
First Half – TW1	0.59	1.88	0.31	.75
First Half – TW2	-1.12	1.4	-0.8	.42
Second Half – TW1	-0.11	3.14	-0.04	.97
Second Half – TW2	0.02	2.98	0.01	.99

Formula in R: *Fixation ~ Congruency + (1+Congruency|Participant) + (1+Congruency|Item)*

Appendix B

Appendix B: I – Cloze Test

English Cloze Test

Please fill in the gaps by using the words given in brackets ().

1. Adam's eyes were closed, so Jill ________________ (think) he was asleep. But he wasn't!
2. Should I tell my mother that I _________________________ (crash) her car into a lamp post last night?
3. Now that my uncle _______________ (grow) his own vegetables for the last 5 years, he refuses to buy them from supermarkets.
4. Every time I go to the bank, I ___________________ (take) my wallet with me.
5. Jane always _______________ (walk) to work, even in the winter.
6. Don't be afraid of airplanes. Remember that they _______________ (fly) safely for many years since the Wright brothers invented the first one in 1903.

1. The train to Moscow always ______________ (leave) at 7.30 a.m. from platform four.
2. Ever since she finished the book by Stephen King, Lucy _______________ (be) afraid to go to bed.
3. Last week, I ______________ (visit) my friend who lives in Spain. We went to the beach every day.
4. Tyler loves listening to music. He _______________ (play) the drums for three years now.
5. When Vivian was a child, she ___________________ (like) to play in the garden.
6. Sarah often _______________ (forget) to turn off the lights when she leaves her flat.

1. Perry ______________ (go) camping since he was five. He still likes it very much.

2. The students ______________ (admire) their friend because he is always so calm.
3. Ernie coughed so loudly that he _________________ (wake up) the cat.
4. Every time Lisa is drunk, she _____________ (lose) her phone.
5. When Bob pushed his brother down the stairs, his parents ______________ (be) angry at him.
6. Isabel _____________ (dream) of becoming prom queen since she was in grade seven.

1. Usually, Catherine _______________ (weep) easily, but today she needs to be strong.
2. Because John had a strong fever, the doctor _____________ (give) him antibiotics last week.
3. Ever since Mary got rid of her braces, she ______________ (receive) many compliments.
4. For years now, Allan _____________ (want) to ask his best friend out for a date. However, he is not brave enough.
5. Max follows the same routine every morning. First, he ________________ (get up), and then he takes a shower.
6. When the girl started her homework, she _______________ (notice) that it was still in the school building.

1. When someone asks you a question, you usually _______________ (answer) it.
2. Ever since he received the diagnosis, David _____________ (pray) for an organ donor.
3. Because I ________________ (clean) the windows yesterday, I don’t have to do it today.
4. Ever since she saw a horse for the first time, Cortney __________________ (long) to own one herself.
5. Last month, Ben and his wife ___________________ (spend) their weekend in Paris. They liked it there.
6. Jim cannot get enough of music. He _____________ (buy) new CDs every month.

German Cloze Test

Bitte füllen Sie die Lücken aus, indem Sie die Wörter in den Klammern () benutzten.

1. Normalerweise ___________________________________ (Christopher, essen, gesund), aber heute hat er keine Zeit zu kochen.
2. Weil die Vorlesung gestern sehr langweilig war, _____________________________ (ich, nicht zuhören).
3. Seit Melanie ihre neue Arbeit gefunden hat, ____ (sie, schreiben, uns, selten).
4. Eine ganze Woche lang ____ (Johannes, feiern, seinen Geburtstag). Heute schläft er den ganzen Tag.
5. Jeden Sonntag trifft sich Familie Hausmann. Sie ______________________________________ (sitzen, um 12 Uhr, zusammen) und essen mittag.
6. Als wir nach Hause gegangen sind, __________________________________ (wir, bemerken), dass es sehr kalt war.

1. Immer ____ (mein Lehrer, kommen, 5 Minuten zu spät).
2. Seit Jens sein Studium abgeschlossen hat, ____ (er, finden, keine Arbeit).
3. Letzte Woche _____________________________________ (Ben, kaufen, die Kamera), und jetzt hat er kein Geld auf seinem Konto.
4. Meine Freundin liebt Tiere. Seit einem Jahr _____________________________________ (sie, essen, kein Fleisch).
5. Als Tom klein war, ______________________________________ (er, weinen, viel).
6. Marco _________________________________ (sprechen, Spanisch, oft), wenn er wütend ist.

1. Seitdem ich sie kenne, ______________________________________ (Jan und Carla, wohnen, in München).
2. Er ____ (Musik, hören), weil sie ihn beruhigt.
3. Eric hat so lange geschlafen, dass er _____________________________________ (verpassen, die Vorlesung).
4. Jedes Mal wenn ich ins Shoppingcenter gehe, _______________________________________ (ich, kaufen, viele Klamotten).
5. Als ich den ersten Preis gewonnen habe, ____ (ich, sich fühlen, glücklich).
6. Seit meinem 6. Lebensjahr ____ (ich, haben, eine Katzenallergie).

1. Weil dein Auto draußen war, __________________________________ (Marta, denken), dass du zu Hause bist.
2. Soll ich meinem Chef schreiben, dass ____ (ich, vergessen, das Treffen, gestern)?
3. Seit Angelika in den letzten 3 Jahren ____ (machen, Yoga, zu Hause), zahlt sie nicht mehr für das Fitnessstudio.
4. Immer wenn _______________________________ (Julian, studieren), hat er Kopfschmerzen.
5. Jedes Mal__________________________________ (meine Eltern, sich streiten), wenn sie eine Reise organisieren.
6. Seitdem sie ______________________________________ (kaputt machen, das Fahrrad), muss sie zu Fuß zur Arbeit.

1. Normalerweise, wenn man bei der Arbeit ist, ____ (man, hören, keine Musik).

2. Seitdem Thomas Helena kennengelernt hat, ____ (er, glauben, an die Liebe, wieder).
3. Weil meine Schwester ____ (zahlen, meine Reise, gestern), habe ich mehr Geld auf dem Konto.
4. Von Kindheit an ____ (Daniel, Angst haben, vor Tieren).
5. Letzten Monat _____________________________________ (Lisa, fallen, vom Fahrrad). Es hat wehgetan.
6. Sie ist süchtig nach Zucker. Jeden Tag ____ (sie, kaufen, Schokolade).

Croatian Cloze Test

Dopuni sljedeće rečenice glagolom u zagradi u odgovarajućem obliku:

1. Vanja odmalena ___________________ (planirati) postati liječnica.
2. Trebam li te podsjetiti da ___________________ (zaboraviti) na moj rođendan prije dva dana?
3. Budući da ne može biti na jednom mjestu, Marina ___________________ (putovati) svakog mjeseca u novu državu.
4. Kad smo počeli sa spremanjem kuće, ___________________ (naći) nečiju novčanicu od sto kuna.
5. Moji roditelji obično ___________________ (svratiti) petkom u goste.
6. Koliko se već godina ___________________ (dopisivati), i nikako da se sretnete uživo.

1. Moja djeca uvijek ___________________ (ići) u školu u sedam i trideset ujutro.
2. Prošlog mjeseca ___________________ (otputovati) u Rim. Svaki smo dan išli u neki novi muzej.
3. Često ___________________ (slušati) laganu glazbu, posebno kad sam pod stresom.
4. Marko od svoje šeste godine ___________________ (svirati) frulu, a sad je dijelom svjetski poznatog orkestra.
5. Prije tri godine ___________________ (upoznati) moju buduću suprugu. Sad imamo dvoje dece.
6. Otkad se vratila s puta, neprestano ___________________ (govoriti) o religiji i spiritualnosti.

1. U posljednje dvije godine ___________________ (ići) svako jutro na trčanje i sad se osjećamo mnogo zdravije.
2. Budući da je uvijek puna poštovanja prema kolegama, Jelenu svi ___________________ (voljeti) na poslu.

3. Otkad je prvi put bila u Italiji, ___________________ (željeti) se barem još jednom vratiti.
4. Nisam znala da mi je sastavak toliko loše napisan da ___________________ (pasti) ispit.
5. Mali Bojan obično ___________________ (plakati) kad ide kod zubara, ali danas je miran.
6. Kad sam rekla da sam trudna, svi ___________________ (biti) sretni.

1. Zbog lošeg ponašanja, učenici ___________________ (izbačeni) iz škole.
2. Otkad sam dobila posao u banci, svi ___________________ (misliti) da sam bogata.
3. Mi već danima ___________________ (planirati) ići na kupanje, ali vrijeme nikako da se popravi.
4. Budući da si se okrenula, ja ___________________ (misliti) da si htjela otići.
5. Svaki put kad pomislim na svoju prvu ljubav, ___________________ (zaboljeti) me srce.
6. Kad se probudim, prvo ___________________ (provjeriti) svoj mobitel i onda nastavim sa svojim danom.

1. Kad sam bila malena, mama me ___________________ (grditi) da sam preglasna.
2. Svaki put kad idem na posao ___________________ (osjećati) nervozu.
3. Uvijek je bio očaran kazalištem. Već godinu dana ___________________ (ići) na satove glume i svakim danom je sve bolji.
4. Kad učim cijeli dan, obično me ___________________ (boljeti) glava.
5. Otkad su se Nikolini roditelji rastali, on bolje ___________________ (funkcionirati).
6. Ne moraš danas kuhati jer ti ___________________ (ostati) hrane od jučerašnjeg ručka.

Spanish Cloze Test

Completa las frases conjugando los verbos que están entre paréntesis:

1. Desde que Marta era niña, ___________________ (tomar) clases de ballet.
2. El mes pasado ___________________ (ir) a Roma. Cada día visitamos un nuevo museo.
3. Porque a Javier no le gusta su trabajo, él ___________________ (viajar) cada mes a un nuevo país.
4. Cuando empezamos con la movida, ___________________ (descubrir) que teníamos muchos muebles.
5. Mi hijo generalmente ___________________ (entrenar) en el gimnasio.
6. Desde hace muchos años María y Marc han estado hablando por Skype, pero aún no ___________________ (encontrarse).

1. Mis niños siempre ___________________ (ir) a la escuela a las ocho de la mañana.
2. Te tengo que acordar que ayer ___________________ (olvidar) mi cumpleaños?
3. Cuando quero comer más sano, ___________________ (comer) pescado más frecuentemente.
4. Desde su primer concierto, Kanye West ya ___________________ (visitar) veinte países.
5. Hace tres años Alejandra ___________________ (finalizar) una licenciatura en psicología.
6. Desde que regresé a Chile, ___________________ (comenzar) a recorrer el país con mis mejores amigos de la infancia.

1. Durante los últimos cinco años, mis padres ___________________ (salir) a correr cada día.
2. Debido a su situación, Juan no ___________________ (poder) correr el riesgo de visitar a su familia.

3. Desde mis vacaciones en Roma, ___________________ (comprar) muchos libros en Italiano.
4. No sabía que mi redacción era tan horrible, que ___________________ (tener) que escribirlo de nuevo.
5. Los gerentes normalmente ___________________ (supervisar) los equipos de empleados, pero hoy tienen una reunión.
6. Cuando le dije que Alejandro se había vuelto más cauteloso, mi mama ___________________ (decir) que los grandes cambios empiezan primero en el interior.

1. Por causa de su malnutrición, mi mujer ___________________ (terminar) en el hospital.
2. Desde que me casé y tuvimos hijos, empacar ___________________ (convertirse) en todo un arte.
3. Porque dejaste tu bolsa, ___________________ (pensar) que ibas a regresarte.
4. Durante siglos, las comunidades locales ___________________ (proceder) a determinar sus valores patrimoniales.
5. Cada vez que uso el ordenador, ___________________ (ser) una experiencia completamente nueva!
6. Cuando me despierto, siempre ___________________ (sentir) un dolor en mi cabeza.

1. Cuando fui a Alemania, ___________________ (encontrar) el amor de mi vida.
2. Todas las mañanas, de camino a mi trabajo, ___________________ (ponerse) nervioso.
3. Desde hace un año que ___________________ (tener) problemas digestivos.
4. Mi amigo típicamente ___________________ (cantar) en las bodas y cumpleaños.
5. Desde que se separaron, la mujer no ___________________ (tener) ningún contacto con su ex marido.

6. No tienes que cocinar hoy, porque el fin de semana mi suegra ____________________ (preparar) mucha comida.

Appendix B: II – AJT

List 1

Please tick (X) whether the following sentences are acceptable in English. If they are not acceptable, please underline what is wrong with them as shown in the example.

Sentence	correct	wrong
When Hannah turned off the news, she sighed. It was time to go to work.	X	
When the dog licked the little <u>boy face</u>, the parents pulled their son away. They were afraid of bacteria.		X
At first, Joe liked Mary's old school-friends. He does not think they are boring.		
Daisy wanted to get a better view of the night sky and therefore climbed on top of her roof. Unfortunately, there were to many clouds to see a single star.		
When he saw her, Sam has thought Jenny was beautiful. However, he is far too nervous to speak to her.		
Because the audience did not laugh at any of his jokes, the comedian left the stage. This was a sad day for her.		
Since he moved in, my old neighbor has visited our house. He brought us a cake.		
Because her dog did not stop barking, Pamela could not sleep all night. She even tried putting the pillow above her head.		
Since last week, the cat ate only fish. She now also eats meat.		
There was not one visitor who left the zoo without having a look at the elephants. The elephants were even popularer than the penguins.		
Since last Friday, Mark has seen the same film three times. He really loved it.		
The musician was very excited before his first concert. He only entered the stage when his friends were watching him.		
A year ago, William has met his best friend after work every Friday. Now he spends every night with his girlfriend.		
Even though she did not expect him to call her, Roberta gave her number to the man on the train. Surprisingly, he gave her a call the next day.		
Since she was ten years old, Brenda wanted to be an actress. She now works in a hospital.		

I usually walk to my office when I have to work. However, today I need more time and so I take the bus.		
Last week, James went swimming every day. Now he is getting bored of it.		
Because Blake missed his cat too much, he returned from her vacation a day earlier. His cat was very happy to see him.		
For the last three days, Tom has felt very unwell. He could not even go to work.		
As Ella and Madison watched a scary movie together, Ella could not help but closes her eyes. Madison did not notice this, though.		
Last year, Kate has studied French in her spare time. She now wants to learn German.		
Because Stephen always forgot where he left his keys, he began noting it down. Unfortunately, he could not remember where he put his notes either.		
Once many years ago, Matt was a successful businessman. He now feels unsatisfied with his life.		
When Harvey stepped into the shower, he discovered a huge spiders on the wall. Therefore, he decided to take a bath instead.		
Since her baby was born, Jenny wanted to escape from her life. She was very stressed out.		
Even though Marcus tried the recipe for the first time, he prepared dinner for the whole family. He was glad everyone liked it.		

List 2

Please tick (X) whether the following sentences are acceptable in English. If they are not acceptable, please underline what is wrong with them as shown in the example.

Sentence	correct	wrong
When Hannah turned off the news, she sighed. It was time to go to work.	X	
When the dog licked the little <u>boy face</u>, the parents pulled their son away. They were afraid of bacteria.		X
Initially, the cat ate only fish. She now also eats meat.		
Daisy wanted to get a better view of the night sky and therefore climbed on top of her roof. Unfortunately, there were to many clouds to see a single star.		

At first, Joe has liked Mary’s old school-friends. He does not think they are boring.		
Because the audience did not laugh at any of his jokes, the comedian left the stage. This was a sad day for her.		
Since he first saw her, Sam has thought Jenny was beautiful. However, he is far too nervous to speak to her.		
Because her dog did not stop barking, Pamela could not sleep all night. She even tried putting the pillow above her head.		
Since he moved in, my old neighbor visited our house. He brought us a cake.		
There was not one visitor who left the zoo without having a look at the elephants. The elephants were even popularer than the penguins.		
For a year now, William has met his best friend after work every Friday. Now he spends every night with his girlfriend.		
The musician was very excited before his first concert. He only entered the stage when his friends were watching him.		
Last week, James has gone swimming every day. Now he is getting bored of it.		
Even though she did not expect him to call her, Roberta gave her number to the man on the train. Surprisingly, he gave her a call the next day.		
Since last Friday, Mark saw the same film three times. He really loved it.		
I usually walk to my office when I have to work. However, today I need more time and so I take the bus.		
When she was ten years old, Brenda wanted to be an actress. She now works in a hospital.		
Because Blake missed his cat too much, he returned from her vacation a day earlier. His cat was very happy to see him.		
Since last year, Kate has studied French in her spare time. She now wants to learn German.		
As Ella and Madison watched a scary movie together, Ella could not help but closes her eyes. Madison did not notice this, though.		
Once many years ago, Matt has been a successful businessman. He now feels unsatisfied with his life.		
Because Stephen always forgot where he left his keys, he began noting it down. Unfortunately, he could not remember where he put his notes either.		
Before her baby was born, Jenny wanted to escape from her life. She was very stressed out.		

When Harvey stepped into the shower, he discovered a huge spiders on the wall. Therefore, he decided to take a bath instead.		
For the last three days, Tom felt very unwell. He could not even go to work.		
Even though Marcus tried the recipe for the first time, he prepared dinner for the whole family. He was glad everyone liked it.		

List 3

Please tick (X) whether the following sentences are acceptable in English. If they are not acceptable, please underline what is wrong with them as shown in the example.

Sentence	correct	wrong
When Hannah turned off the news, she sighed. It was time to go to work.	X	
When the dog licked the little <u>boy face</u>, the parents pulled their son away. They were afraid of bacteria.		X
Yesterday, my old neighbor visited our house. He brought us a cake.		
Daisy wanted to get a better view of the night sky and therefore climbed on top of her roof. Unfortunately, there were to many clouds to see a single star.		
Initially, the cat has eaten only fish. She now also eats meat.		
Because the audience did not laugh at any of his jokes, the comedian left the stage. This was a sad day for her.		
Since he met them, Joe has liked Mary's old school-friends. He does not think they are boring.		
Because her dog did not stop barking, Pamela could not sleep all night. She even tried putting the pillow above her head.		
Since he first saw her, Sam thought Jenny was beautiful. However, he is far too nervous to speak to her.		
There was not one visitor who left the zoo without having a look at the elephants. The elephants were even popularer than the penguins.		
Since the summer, James has gone swimming every day. Now he is getting bored of it.		

The musician was very excited before his first concert. He only entered the stage when his friends were watching him.		
When she was ten years old, Brenda has wanted to be an actress. She now works in a hospital.		
Even though she did not expect him to call her, Roberta gave her number to the man on the train. Surprisingly, he gave her a call the next day.		
For a year now, William met his best friend after work every Friday. Now he spends every night with his girlfriend.		
I usually walk to my office when I have to work. However, today I need more time and so I take the bus.		
Last Friday, Mark saw the same film three times. He really loved it.		
Because Blake missed his cat too much, he returned from her vacation a day earlier. His cat was very happy to see him.		
Since he was twenty, Matt has been a successful businessman. He now feels unsatisfied with his life.		
As Ella and Madison watched a scary movie together, Ella could not help but closes her eyes. Madison did not notice this, though.		
Before her baby was born, Jenny has wanted to escape from her life. She was very stressed out.		
Because Stephen always forgot where he left his keys, he began noting it down. Unfortunately, he could not remember where he put his notes either.		
Three days ago, Tom felt very unwell. He could not even go to work.		
When Harvey stepped into the shower, he discovered a huge spiders on the wall. Therefore, he decided to take a bath instead.		
Since last year, Kate studied French in her spare time. She now wants to learn German.		
Even though Marcus tried the recipe for the first time, he prepared dinner for the whole family. He was glad everyone liked it.		

List 4

Please tick (X) whether the following sentences are acceptable in English. If they are not acceptable, please underline what is wrong with them as shown in the example.

Sentence	correct	wrong

When Hannah turned off the news, she sighed. It was time to go to work.	X	
When the dog licked the little <u>*boy face*</u>*, the parents pulled their son away. They were afraid of bacteria.*		X
When he saw her, Sam thought Jenny was beautiful. However, he is far too nervous to speak to her.		
Daisy wanted to get a better view of the night sky and therefore climbed on top of her roof. Unfortunately, there were to many clouds to see a single star.		
Yesterday, my old neighbor has visited our house. He brought us a cake.		
Because the audience did not laugh at any of his jokes, the comedian left the stage. This was a sad day for her.		
Since last week, the cat has eaten only fish. She now also eats meat.		
Because her dog did not stop barking, Pamela could not sleep all night. She even tried putting the pillow above her head.		
Since he met them, Joe liked Mary's old school-friends. He does not think they are boring.		
There was not one visitor who left the zoo without having a look at the elephants. The elephants were even popularer than the penguins.		
Since she was ten years old, Brenda has wanted to be an actress. She now works in a hospital.		
The musician was very excited before his first concert. He only entered the stage when his friends were watching him.		
Last Friday, Mark has seen the same film three times. He really loved it.		
Even though she did not expect him to call her, Roberta gave her number to the man on the train. Surprisingly, he gave her a call the next day.		
Since the summer, James went swimming every day. Now he is getting bored of it.		
I usually walk to my office when I have to work. However, today I need more time and so I take the bus.		
A year ago, William met his best friend after work every Friday. Now he spends every night with his girlfriend.		
Because Blake missed his cat too much, he returned from her vacation a day earlier. His cat was very happy to see him.		

Since her baby was born, Jenny has wanted to escape from her life. She was very stressed out.		
As Ella and Madison watched a scary movie together, Ella could not help but closes her eyes. Madison did not notice this, though.		
Three days ago, Tom has felt very unwell. He could not even go to work.		
Because Stephen always forgot where he left his keys, he began noting it down. Unfortunately, he could not remember where he put his notes either.		
Last year, Kate studied French in her spare time. She now wants to learn German.		
When Harvey stepped into the shower, he discovered a huge spiders on the wall. Therefore, he decided to take a bath instead.		
Since he was twenty, Matt was a successful businessman. He now feels unsatisfied with his life.		
Even though Marcus tried the recipe for the first time, he prepared dinner for the whole family. He was glad everyone liked it.		

Appendix B: III – SPR

Self-paced reading task: Experimental items (Roberts & Liszka, 2013)

1. At first / Since he met them, Joe liked / has liked Mary's old school-friends. He doesn't think they're boring.
2. Initially / Since last week, the cat ate / has eaten only fish. She now also eats meat.
3. Yesterday / Since he moved in, my old neighbour visited / has visited our house. He brought us a cake.
4. When he saw her / Since he first saw her, Sam thought / has thought Jenny was beautiful. However, he's far too nervous to speak to her.
5. Last week / Since the summer, James went / has gone swimming every day. Now he's getting bored of it.
6. When she was ten years old / Since she was ten years old, Brenda wanted / has wanted to be an actress. She now works in a hospital.
7. Last Friday / Since last Friday, Mark saw / has seen the same film three times. He really loved it.
8. A year ago / For a year now, William met / has met his best friend after work every Friday. Now he spends every night with his girlfriend.
9. Once many years ago / Since he was twenty, Matt was / has been a successful businessman. He now feels unsatisfied with his life.
10. Before her baby was born / Since her baby was born, Jenny wanted / has wanted to escape from her life. She was very stressed out.
11. Three days ago / For the last three days, Tom felt / has felt very unwell. He couldn't even go to work.
12. Last year / Since last year, Kate studied / has studied French in her spare time. She now wants to learn German.
13. When she first started her job /Since she first started her job, Emma loved / has loved the work very much. It's not very exciting now.
14. Initially / Since the beginning, the band was / has been very successful. They sold a million records.

15. Last spring / Since spring, Bert planted / has planted many roses in the garden. He wanted to enter into a gardening competition.
16. At Christmas / Since Christmas, Barbara spent / has spent too much money. Her credit card bill was enormous.
17. On his birthday / Since his birthday, Paul met / has met two lovely women. He wants to go out with both of them.
18. Many years ago / For many years now, Judith thought / has thought about joining the army. It's a dangerous profession.
19. When he first started cooking / Since he first started cooking, Alan enjoyed / has enjoyed making pasta most of all. He now likes making desserts.
20. When he finished university / Since he finished university, Jerry thought / has thought about starting a business. He wanted to be a millionaire.
21. Last month / For the last month, Sandra felt / has felt unhappy at work. She even thought about leaving.
22. At first / For months now, Christine wanted / has wanted to marry Gary. Now she finds him unpleasant.
23. In February / Since February, Ben crashed / has crashed his car four times. He now pays a lot for his insurance.
24. Last year / Since the summer, Michael learnt/has learnt to play poker. He now wants to become a professional.

Appendix B: IV – AJT median split

Table 165. L1 German: The effect of Type for the low and high tense awareness group in the case of past simple items for each critical segment.

	Estimate	SE	*t*-value	*p*-value
Low:V	1.01	19.85	0.05	.96
Low:V1	-12.29	18.41	-0.67	.51
Low:V2	-37.60	24.30	-1.55	.14
Low:V3	-23.82	27.96	-0.85	.41
High:V	9.40	31.02	0.30	.77
High:V1	33.38	34.09	0.98	.34
High:V2	7.41	35.81	0.20	.84
High:V3	-40.69	65.48	-0.62	.55

Formula in R: *DV ~ Type + (1 + Type|Participant) + (1+Type|Item)*

Table 166. L1 German: The effect of Type for the low and high tense awareness group in the case of present perfect items for each critical segment.

	Estimate	SE	*t*-value	*p*-value
Low:V	-0.88	19.99	-0.04	.97
Low:V1	-5.51	20.96	-0.26	.80
Low:V2	21.88	19.47	1.12	.28
Low:V3	37.61	18.80	2.00	.06
High:V	-25.86	29.31	-0.88	.39
High:V1	26.20	39.75	0.66	.53
High:V2	20.43	39.87	0.51	.62
High:V3	-53.63	46.39	-1.16	.27

Formula in R: *DV ~ Type + (1 + Type|Participant) + (1+Type|Item)*

Table 167. L1 Croatian: The effect of Type for the low and high tense awareness group in the case of past simple items for each critical segment.

	Estimate	SE	*t*-value	*p*-value
Low:V	-26.14	17.06	-1.53	.14
Low:V1	-8.612	18.40	-0.47	.65
Low:V2	1.103	20.05	0.06	.96
Low:V3	-6.77	16.32	-0.42	.68
High:V	-46.31	86.81	-0.53	.61
High:V1	31.58	34.51	0.92	.37
High:V2	11.19	76.10	0.15	.88
High:V3	25.03	48.64	0.52	.61

Formula in R: *DV ~ Type + (1 + Type|Participant) + (1+Type|Item)*

Table 168. L1 German: The effect of Type for the low and high tense awareness group in the case of present perfect items for each critical segment.

	Estimate	SE	*t*-value	*p*-value
Low:V	-7.052	17.27	-0.41	.69
Low:V1	-10.13	21.94	-0.46	.65
Low:V2	14.04	23.24	0.60	.55
Low:V3	-22.44	18.05	-1.24	.23
High:V	54.43	36.99	1.47	.18
High:V1	91.70	65.27	1.41	.19
High:V2	11.22	52.32	0.21	.53
High:V3	11.67	30.65	0.38	.71

Formula in R: *DV ~ Type + (1 + Type|Participant) + (1+Type|Item)*

Table 169. L1 Spanish: The effect of Type for the low and high tense awareness group in the case of past simple items for each critical segment.

	Estimate	SE	*t*-value	*p*-value
Low:V	30.24	31.55	0.96	.34
Low:V1	-6.078	27.76	-0.22	.89
Low:V2	-32.53	20.74	-1.57	.12
Low:V3	6.60	34.89	0.19	.85
High:V	-25.48	62.00	-0.41	.68
High:V1	5.99	48.20	0.12	.90
High:V2	11.20	56.91	0.20	.85
High:V3	6.34	71.24	0.09	.93

Formula in R: *DV ~ Type + (1 + Type|Participant) + (1+Type|Item)*

Table 170. L1 Spanish: The effect of Type for the low and high tense awareness group in the case of present perfect items for each critical segment.

	Estimate	SE	*t*-value	*p*-value
Low:V	-50.85	30.72	-1.66	.11
Low:V1	42.18	32.88	1.28	.21
Low:V2	37.25	33.63	1.11	.29
Low:V3	17.67	33.12	0.53	.61
High:V	-31.00	44.72	-0.69	.51
High:V1	-27.79	62.25	-0.45	.66
High:V2	-87.94	82.82	-1.06	.31
High:V3	-1.44	43.42	-0.03	.97

Formula in R: *DV ~ Type + (1 + Type|Participant) + (1+Type|Item)*

Appendix C

Appendix C: I – Cloze Test

English cloze test (Roberts & Liszka, 2019)

Please fill in the gaps by using the words given in parentheses ().

The Van

Quite late one evening I _________________ (walk) home alone from college. The wind _ ____________ (blow) hard and it _______________ (pour) with rain, so there __________ ______ (be) no one around. Anyway, the big black van ________________ (drive) past me and _______________ (stop), just where the road ___________________ (curve) round. I ___________________ (decide) to go on, though I ______________ (feel) increasingly uneasy. However, as soon as I __________________ (get) close to the van, it __________ ______ (drive) off. This _________________ (happen) twice more further down the same road. Each time the van ___________________ (pull up) fifty meters ahead of me, _ ____________ (wait) until I almost ________(draw up) with it and then _______________ (pull away) again. By this stage I _______________ (be) absolutely petrified. So, I _____ ____________ (stand) for a moment under a tree. The rain _____________ (come down) in torrents now. I __________________ (shake) and ______________ (wonder) what to do next, when a policeman _________________ (come) past. He _________________ (push) his bike because of the heavy rain. I _____________ (grab) him by the arm and ________ ______ (make) him stop. Then I completely _____________ (go) to pieces. While he ____ ____________ (try) to calm me down, I __________ (hear) the van drive off, thankfully for the last time. I’ve never walked home on my own since.

Croatian cloze test

Izaberi odgovarajući glagol od ponuđenih u zagradi:

Već duže vrijeme imam problema s tehnikom, koja se, iako je naizgled nova, brzo kvari. Jučer sam odlučila da se ______________ (šetam-prošetam) gradom i da ______________ (riješim-rješavam) situaciju sa svojim pokvarenim mobitelom. Dok sam se ______________ (obula-obuvala), primijetila sam da su mi tek kupljene čarape ______________ (pukle-pucale). Odmah sam ih ______________ (skinula-skidala) i ______________ (tražila-potražila) nove. Nisam primijetila da me je sestra ______________ (zvala-nazvala) u isto vrijeme, budući da mi mobitel nije ______________ (bilježio-zabilježio) propušten poziv. ______________ (stavila-stavljala) sam mobitel u torbu i krenula k centru. Dok sam se ______________ (šetala-prošetala) ulicom, ______________ (primijetila-primjećivala) sam da me netko zove. To je bila moja mama koja mi je nešto ______________ (pokazala-pokazivala) rukama. Primijetila sam da joj lice nije uplašeno, već da se ______________ (smiješila-nasmiješila). ______________ (zagrlila-grlila) me je, i onda je ______________ (govorila-progovorila). Izgleda da je moja sestra sve vrijeme ______________ (rodila-rađala) i ______________ (trpjela-pretrpjela) bolove. Sat vremena ranije ______________ (dobila-dobijala) je kćer, koja je, naravno, prvih deset minuta samo ______________ (plakala-zaplakala), a onda ______________ (spavala-zaspala). ______________ (lovili-ulovili) smo taksi do bolnice, jer smo sve vrijeme ______________ (žurili-požurili) da vidimo prinovu. Budući da nam nisu ______________ (dali-davali) da odmah posjetimo moju sestru, ______________ (sjeli-sjedili) smo jedno vrijeme u čekaonici i ______________ (čekali- pričekali) da nas pozovu, dok su liječnici ______________ (pregledali-pregledavali) bebu i majku. Kad sam vidjela sestru kako se ______________ (smiješila-nasmiješila) i ______________ (ljuljala-zaljuljala) bebu, znala sam da će ovaj dan biti jedan od najljepših u mom životu.

Spanish cloze test

Completa el texto conjugando los verbos que están entre paréntesis:

Desde hace unos meses he tenido problemas con algunos aparatos electrónicos, que se rompen muy fácil después de comprarlos. Ayer ____________________ (decidir) dar una vuelta hasta el centro para averiguar por qué mi móvil no funciona bien. Mientras ____________________ (ponerse) mis zapatos ____________________ (notar) que mis calcetines ____________________ (tener) un agujero enorme. Por eso me los ____________________ (quitar) y ____________________ (tratar) de encontrar unos nuevos. Por esta razón no me ____________________ (dar) cuenta que mi hermana me ____________________ (llamar), porque mi móvil no ____________________ (mostrar) la llamada. Inmediatamente después, ____________________ (poner) el móvil en mi bolso y ____________________ (salir) de mi casa. Mientras ____________________ (caminar) por la calle, ____________________ (escuchar) una voz: era mi mamá, que me ____________________ (mostrar) algo con sus manos. Me di cuenta que ella ____________________ (sonreír) todo el tiempo mientras ____________________ (caminar) hacía mí. De repente, me ____________________ (abrazar) y ____________________ (empezar) a hablar. Durante todo este tiempo mi hermana ____________________ (dar) a luz y ____________________ (sufrir) un dolor horrible. Dos horas después, mi nueva sobrina ____________________ (nacer), y de acuerdo a mi hermana, el bebé no ____________________ (parar) de llorar en el primeros minutos. Cuando llegamos al hospital, durante las primeras horas ____________________ (esperar) en la sala de espera. Mientras yo ____________________ (leer) un libro, mi mamá ____________________ (mirar) a cada persona que pasaba por la puerta. En un momento, ____________________ (ver) a mi hermana en la puerta, que ____________________ (sonreírse) y ____________________ (comenzar) a llorar.

Appendix C: II – SPR

Self-paced reading task: Experimental items (Roberts & Liszka, 2019)

1. It was late and the bar was full. As the men drank/were drinking the strong beer was/it was spilled on the floor.

2 Alice and Jim decorated their house every year. When Alice painted/was painting the kitchen walls were/they were covered with many drops.

3. Tony and his friends loved to sing at parties. When Tony sang/was singing the drinking song sounded/it sounded like opera.

4. John and Sam took their guns out into the woods. As John hunted/was hunting the frightened rabbit escaped/it escaped through the dark trees.

5. Susan and her children lived far from her parents. When Susan visited/was visiting the friendly neighbours wanted/they wanted to have a party.

6. The flat was very old and dirty. Even when Joe cleaned/was cleaning the small kitchen smelled/it smelled like old rubbish.

7. The couple sitting next to me at the restaurant got up to leave. As I watched/was watching the drunk man tripped/he tripped over my chair.

8. There were two Italian chefs working in the restaurant. Because Mario cooked/was cooking the fresh pasta was/it was made to real perfection.

9. There were many different kinds of vehicles at the company. When George drove/was driving the big lorry made/it made loud and strange noises.

10. The opera company had three different conductors. When Mr Osaka conducted/was conducting the symphony orchestra played/it played better than anyone else.

11. On Saturday nights, the police department was very busy. When the sheriff patrolled/was patrolling the whole town was/it was safe and secure.

12. Jenny and Sam went out for a ride. While Jenny rode/was riding the young horse decided/it decided to jump a high fence.

13. Maggie and Fred were the two supervisors at the factory. When Maggie supervised/was supervising the night staff worked/they worked extremely efficiently.

14. In the park, two children were eating some ice-cream. As the boy ate/was eating the chocolate ice-cream dropped/it dropped down his clean shirt.

15. In the garden, a boy and girl wanted to go up into the tree-house. While the girl climbed/was climbing the tall tree started/it started to shake dangerously.
16. Sarah and Jane owned a shop selling old furniture. When Sarah polished/was polishing the cheap furniture looked/it looked new and expensive.
17. Rita and Violet took turns to do the washing. When Rita washed/was washing the delicate clothes were/they were torn to pieces.
18. The lawyers' office was rather busy. As the secretary typed/was typing the eviction notice was/it was cancelled very suddenly.
19. Yesterday in my art class, the model sat in the same position for hours. As I drew/was drawing the patient woman tried/she tried very hard to keep still.
20. The driving instructor almost gave up on Mrs. Brown. When the woman parked/was parking the new car was/it was always at an angle.

Appendix C: III – Tables

L1 German

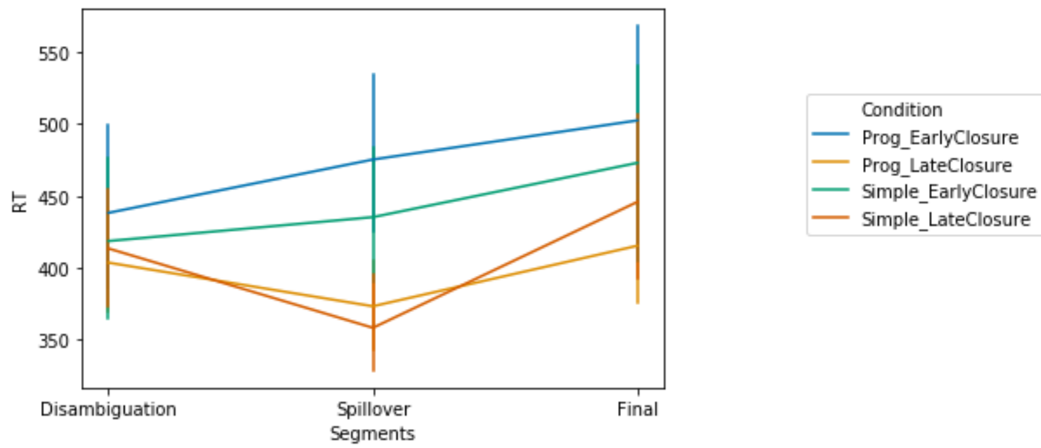


Figure 55. L1 German L2 learners' reading times (RTs) on the three segments during SPR in ms for the low aspect awareness group (error bars represent the variability of data) (*n* = 12).

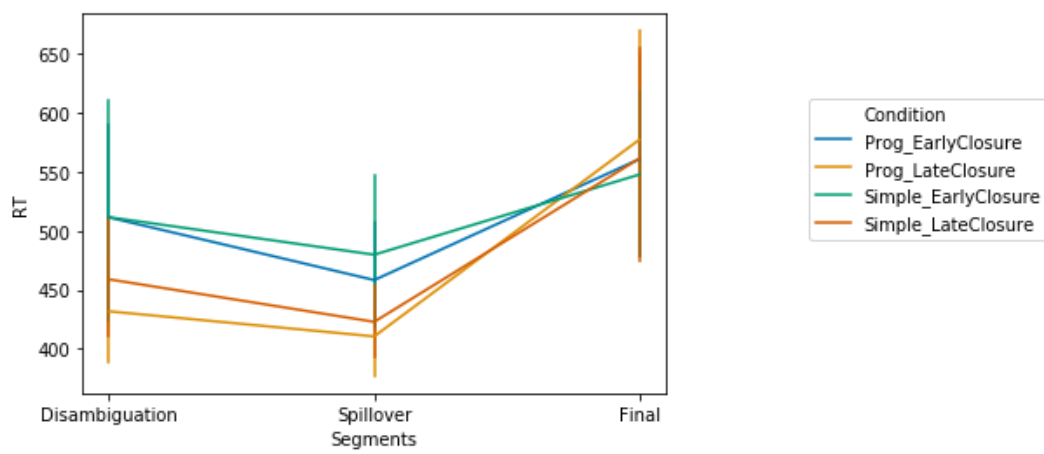


Figure 56. L1 German L2 learners' reading times (RTs) on the three segments during SPR in ms for the high aspect awareness group (error bars represent the variability of data) (*n* = 12).

Cloze test – L1 German low aspect awareness group

Table 171. Results for the L1 German low aspect awareness group on the disambiguation segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	431.9	51.15	8.44	< .001
Type	-26.30	30.33	-0.87	.39
Aspect	-9.84	35.56	-0.28	.78
Type*Aspect	26.05	34.26	0.76	.45

Formula in R: *Disambiguation ~ Type*Aspect+ (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 172. Results for the L1 German low aspect awareness group on the spillover segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	472.57	48.26	9.79	< .001
Type	-101.06	31.33	-3.23	.004
Aspect	-36.34	21.80	-1.67	.10
Type*Aspect	27.98	27.45	1.02	.31

Formula in R: *Spillover ~ Type*Aspect+ (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 173. Results for the L1 German low aspect awareness group on the final segment

FINAL	Estimate	SE	*t*-value	*p*-value
(Intercept)	497.69	51.84	9.6	< .001
Type	-78.95	34.91	-2.26	.03
Aspect	-24.03	35.82	-0.67	.51
Type*Aspect	59.48	39.33	1.51	.13

Formula in R: *Final ~ Type*Aspect+ (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Cloze test – L1 German high aspect awareness group

Table 174. Results for the L1 German high aspect awareness group on the disambiguation segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	522.11	74.53	7.01	< .001
Type	-100.58	53.15	-1.89	.07
Aspect	1.19	37.33	0.03	.97
Type*Aspect	25.60	47.60	0.54	.59

Formula in R: *Disambiguation ~ Type*Aspect + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 175. Results for the L1 German high aspect awareness group on the spillover segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	457.22	44.71	10.23	< .001
Type	-53.49	33.43	-1.60	.13
Aspect	30.09	24.82	1.21	.23
Type*Aspect	-19.82	31.72	-0.63	.53

Formula in R: *Spillover ~ Type*Aspect + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 176. Results for the L1 German high aspect awareness group on the final segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	554.41	81.52	6.80	< .001
Type	-4.13	38.04	-0.11	.91
Aspect	-10.30	39.92	-0.26	.80
Type*Aspect	10.44	48.45	0.22	.83

Formula in R: *Final ~ Type*Aspect + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

L1 Croatian

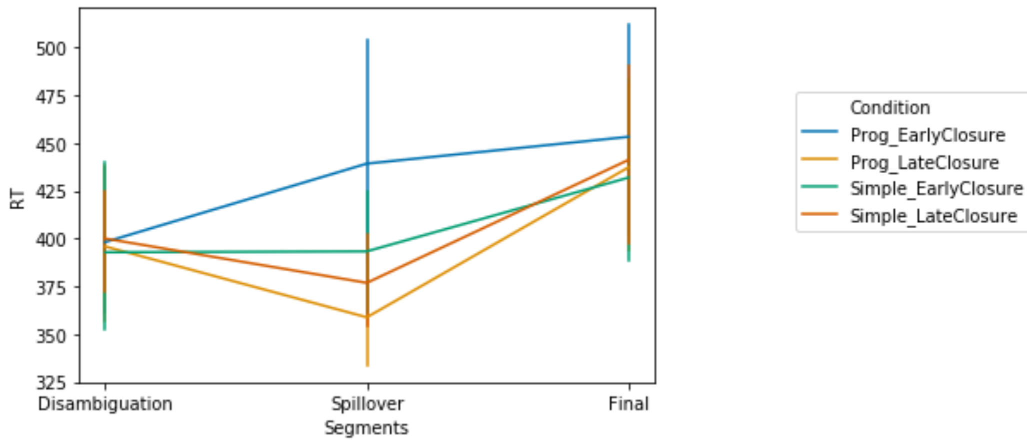


Figure 57. L1 Croatian L2 learners' reading times (RTs) on the three segments during SPR in ms (error bars represent the variability of data) for the low aspect awareness group (*n* = 20).

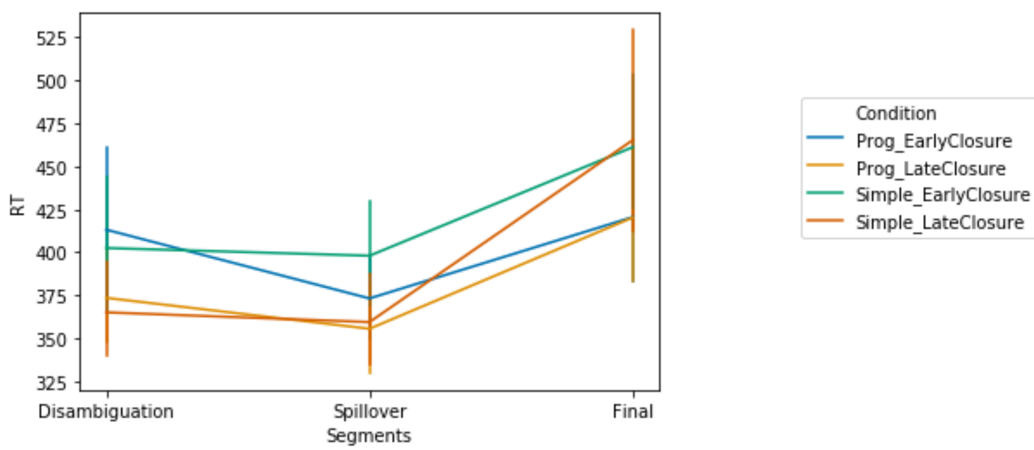


Figure 58. L1 Croatian L2 learners' reading times (RTs) on the three segments during SPR in ms (error bars represent the variability of data) for the high aspect awareness group (*n* = 20).

Cloze test – L1 Croatian low aspect awareness group

Table 177. Results for the L1 Croatian low aspect awareness group on the disambiguation segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	408.66	27.08	15.10	< .001
Type	-8.02	20.45	-0.39	.70
Aspect	-13.39	21.45	-0.62	.54
Type*Aspect	1.69	27.22	0.06	.95

Formula in R: *Type*Aspect + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 178. Results for the L1 Croatian low aspect awareness group on the spillover segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	421.56	30.62	13.77	< .001
Type	-62.50	23.23	-2.69	.01
Aspect	-24.29	20.59	-1.18	.24
Type*Aspect	44.74	25.92	1.73	.09

Formula in R: *Spillover ~ Type*Aspect + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 179. Results for the L1 Croatian low aspect awareness group on the final segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	449.35	35.18	12.77	< .001
Type	-0.79	31.44	-0.03	.98
Aspect	7.63	24.82	0.31	.76
Type*Aspect	-18.33	34.05	-0.54	.59

Formula in R: *Final ~ Type*Aspect + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Cloze test – L1 Croatian high aspect awareness group

Table 180. Results for the L1 Croatian high aspect awareness group on the disambiguation segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	401.85	49.99	8.04	< .001
Type	-45.07	33.24	-1.36	.19
Aspect	-5.77	25.56	-0.23	.82
Type*Aspect	5.84	28.54	0.20	.84

Formula in R: *Disambiguation ~ Type*Aspect + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 181. Results for the L1 Croatian high aspect awareness group on the spillover segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	368.5	28.04	13.14	< .001
Type	-17.35	19.13	-0.91	.37
Aspect	21.04	17.38	1.21	.23
Type*Aspect	-30.74	23.65	-1.3	.20

Formula in R: *Spillover ~ Type*Aspect + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 182. Results for the L1 Croatian high aspect awareness group on the final segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	407.41	33.90	12.02	< .001
Type	-7.99	30.22	-0.264	.79
Aspect	36.29	27.50	1.32	.19
Type*Aspect	20.66	38.20	0.54	.59

Formula in R: *Final ~ Type*Aspect + (1+Aspect+Type|Participant) + (1+Aspect+Type|Item)*

L1 Spanish

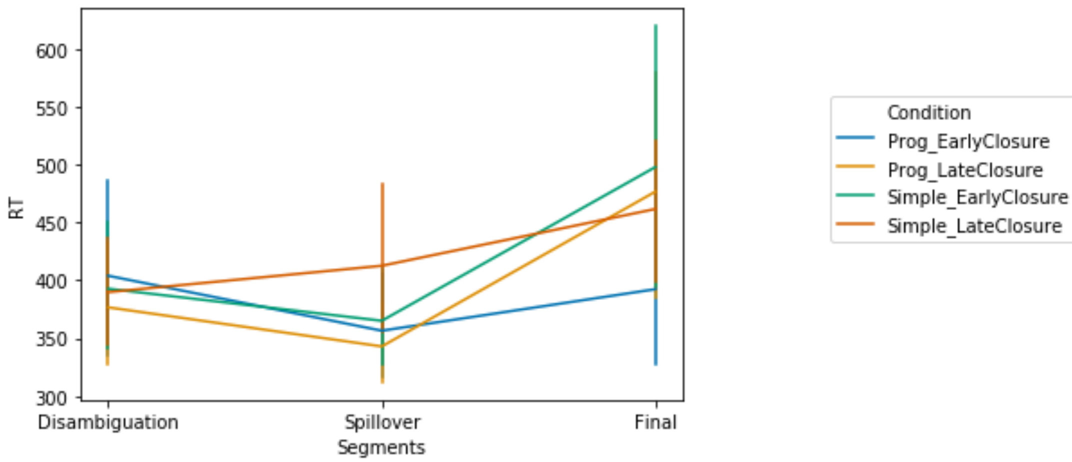


Figure 59. L1 Spanish L2 learners' reading times (RTs) on the three segments during SPR in ms (error bars represent the variability of data) for the low aspect awareness group (n = 11).

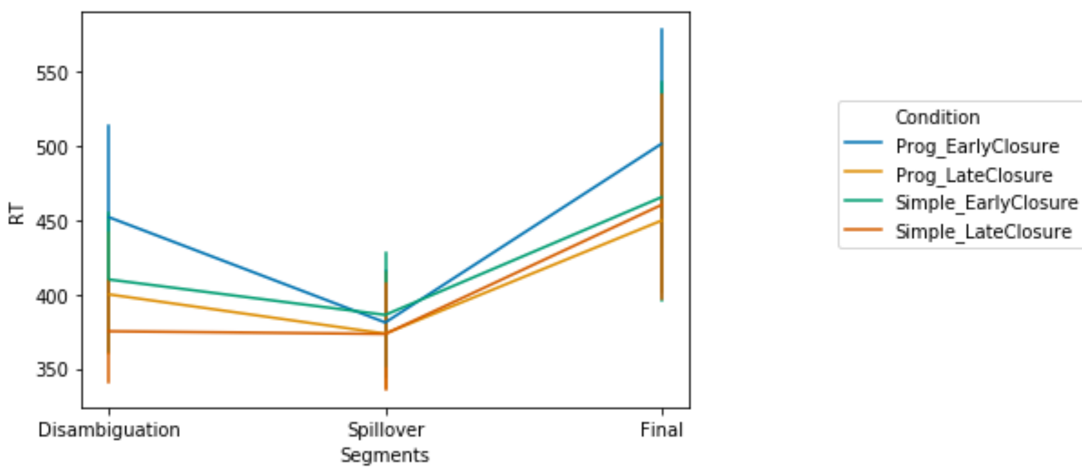


Figure 60. L1 Spanish L2 learners' reading times (RTs) on the three segments during SPR in ms (error bars represent the variability of data) for the high aspect awareness group (n = 12).

Cloze test – L1 Spanish low aspect awareness group

Table 183. Results for the L1 Spanish low aspect awareness group on the disambiguation segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	389.46	49.21	7.91	< .001
Type	-26.83	27.72	-0.97	.34

Aspect	-27.57	24.70	-1.12	.27
Type*Aspect	20.88	31.14	0.67	.50

Formula in R: *Disambiguation ~ Type*Aspect + (1 + Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 184. Results for the L1 Spanish low aspect awareness group on the spillover segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	335.63	29.47	11.39	< .001
Type	-8.91	17.46	-0.51	.61
Aspect	13.48	25.85	0.52	.61
Type*Aspect	32.56	23.16	1.41	.16

Formula in R: *Spillover ~ Type*Aspect + (1 + Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 185. Results for the L1 Spanish low aspect awareness group on the final segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	380.91	59.34	6.42	< .001
Type	54.26	35.75	1.52	.14
Aspect	67.56	30.24	2.23	.03
Type*Aspect	-88.9	40.75	-2.18	.03

Formula in R: *Final ~ Type*Aspect + (1 + Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Cloze test – L1 Spanish high aspect awareness group

Table 186. Results for the L1 Spanish high aspect awareness group on the disambiguation segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	509.03	47.02	10.83	< .001

Type	-87.49	39.47	-2.22	.03
Aspect	-40.92	36.8	-1.11	.27
Type*Aspect	38.51	49.84	0.77	.44

Formula in R: *Disambiguation ~ Type*Aspect + (1 + Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 187. Results for the L1 Spanish high aspect awareness group on the spillover segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	429.36	33.56	12.79	< .001
Type	-27.98	26.54	-1.05	.30
Aspect	-2.99	28.77	-0.10	.92
Type*Aspect	16.37	34.27	0.48	.63

Formula in R: *Spillover ~ Type*Aspect + (1 + Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Table 188. Results for the L1 Spanish high aspect awareness group on the final segment

	Estimate	SE	*t*-value	*p*-value
(Intercept)	596.71	76.09	7.84	< .001
Type	-112.94	61.99	-1.82	.09
Aspect	-61.36	56.72	-1.08	.30
Type*Aspect	128.02	59.33	2.16	.03

Formula in R: *Final ~ Type*Aspect + (1 + Aspect+Type|Participant) + (1+Aspect+Type|Item)*

Beruflicher und wissenschaftlicher Werdegang

04/2017 – 03/2021	**Promotionsstudium Englische Sprachwissenschaft,** Technische Universität Braunschweig, Institut für Anglistik und Amerikanistik, Abteilung Englische Sprachwissenschaft
02/2017 – 07/2020	**Wissenschaftliche Mitarbeiterin (Promotionsstelle),** Technische Universität Braunschweig, Institut für Anglistik und Amerikanistik, Abteilung Englische Sprachwissenschaft
10/2016 - 02/2017	**Promotionsstudium Philosophie,** Alpen-Adria Universität, Institut für Anglistik und Amerikanistik, Angewandte Sprachwissenschaft, Klagenfurt, Österreich
10/2013 - 04/2016	**Master of Arts Angewandte Sprachwissenschaft,** Alpen-Adria Universität, Institut für Anglistik und Amerikanistik, Angewandte Sprachwissenschaft, Klagenfurt, Österreich
10/2015 - 01/2016	**Tutorin,** Alpen-Adria Universität, Institut für Anglistik und Amerikanistik, Angewandte Sprachwissenschaft, Klagenfurt, Österreich
10/2009 - 07/2013	**Bachelor of Arts Philologie**, Fakultät für Rechts-und Wirtschaftswissenschaften, Englische Sprache, Novi Sad, Serbien
09/2005 – 05/2009	**Gymnasium,** Zrenjanin, Serbien

Publikationen

Dobrić, N., & **Cvekić, I.** (2017). The cognitive translation hypothesis and translating proverbs – a case study in English and Serbian. In A. Onysko, E. Graf, W. Delanoy, G. Sigott & N. Dobrić (Eds.), *The Polyphony of English Studies: A Festschrift for Allan James* (pp. 85-94). Tübingen, Germany: Narr Francke Attempto Verlag.

Cvekić, I. (2017). The influence of language distance on third language acquisition: Current research. *Journal of Student Research in Languages and Literatures, 6,* 11-16.

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Cvekić, I. (2016). The influence of early bilingualism on third language proficiency and knowledge. *ÖGSD TAGUNGSBERICHTE, 1*, 11-14.

Cvekić, I. (2016). *Bilinguals as multicompetent users: Effects of bilingualism on the acquisition of English as a third language.* Saarbrücken: AV Akademikerverlag.

Cvekić, I. (2016). Effects of bilingualism: Influence on the acquisition of English as a third language. *Journal of Student Research in Languages and Literatures, 5,* 11-18.

Vorträge

2019 **Cvekić, I.,** & Hopp, H. *L1 grammatical gender transfer during L2 English pronoun processing*. Talk given at the 29th conference of the European Second Language Association, EuroSLA, August 28th-31st, Lund, Sweden.

2018 **Cvekić, I.** *Influence of L1 grammatical gender on L2 discourse processing*. Talk given at the 19. Norddeutsches Linguistisches Kolloquium, March 22nd -23rd, Greifswald, Germany.

2017 **Cvekić, I.** *Cross-linguistic influence in third language acquisition: Lexical and grammatical interactions between Serbian, German & English.* Poster presented at the 2017 LOT Summer School, June 26th-July 7th, Leiden, Netherlands.

2016 **Cvekić, I.** *Is multilingualism a new 'normal'? Reflections of a case study.* Talk given at the M@king It New In English Studies conference, September 15th-17th, Maribor, Slovenia.

2016 **Cvekić, I.** *Vocabulary learning strategies: Tendencies of bilinguals and monolinguals in third language acquisition.* Talk given at the 10th International Conference on Multilingualism and Third Language Acquisition, September 1st-3rd, Vienna, Austria.

2016 **Cvekić, I.** *Is Third language acquisition: Multilinguals as multi-competent users.* Talk given at the 8. ÖGSD Nachwuchstagung, May 21st, Vienna, Austria.

2016 **Cvekić, I.** *The influence of typological distance in third language acquisition: Current research and future perspective.* Talk given at the 21st Symposium of Students in English, April 15th-16th, Timisoara, Romania.

2015 **Cvekić, I.** *Third language vocabulary acquisition: The influence of serbian and hungarian as native languages on the English language.* Talk given at the Situating Strategy Use: The Interplay of Language Learning Strategies and Individual Learner Characteristics conference, October 16th-17th, Klagenfurt, Austria.

2015 **Cvekić, I.** *Effects of bilingualism: Influence on the acquisition of English as a third language.* Talk given at the Alpen Adria Anglistics Conference: Crossing Borders and Challenging Boundaries – Anglistics Studies in the Alps-Adriatic conference, September 25th-27th, Klagenfurt, Austria.

2015 **Cvekić, I.** *Effects of bilingualism: Influence on the acquisition of pupils bilingual in hungarian and Serbian language.* Talk given at the 20th Symposium of Students in English, March 27th-28th, Timisoara, Romania.

2014 **Cvekić, I.** *Conceptual mapping in proverbs: Cognitive equivalents in English and Serbian.* Talk given at the Klagenfurt Conference on Corpus-Based Applied Linguistics (CALK14), October 25th-27th, Klagenfurt, Austria.